Appendix A

USFWS Species List

Appendix A. USFWS Species List

Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in the Counties and/or U.S.G.S. 7 1/2 Minute Quads you requested

Document Numbers: 061110123501, 061110120837, 061110115201, 061110124511, 061110125046, 061110011140, 061110021327, 061110013313

Database Last Updated: October 27, 2006

THORNTON (479B)

Listed Species

Invertebrates
Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

*Lepidurus packard*i - vernal pool tadpole shrimp (E)

Fish
Hypomesus transpacificus - Critical habitat, delta smelt (X)
Hypomesus transpacificus - delta smelt (T)

*Oncorhynchus mykis*s – Critical habitat, Central Valley Steelhead (X) (NMFS)
*Oncorhynchus mykis*s - Central Valley steelhead (T) (NMFS)

Oncorhynchus tshawytscha - Critical Habitat, Central Valley spring-run chinook (X) (NMFS)
Oncorhynchus tshawytscha - Central Valley spring-run chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Ambystoma californiense - California tiger salamander, central population (T)

Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds
Haliaeetus leucocephalus - bald eagle (T)

Mammals

Proposed Species

Amphibians

Birds

Candidate Species

Fish
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)
Oncorhynchus tshawytscha - Critical habitat, Central Valley fall/late fall-run chinook (C) (NMFS)

TERMINOUS (479C)

Listed Species

Invertebrates
Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Lepidurus packardi – Vernal pool tadpole shrimp (E)

Fish
Hypomesus transpacificus - Critical habitat, delta smelt (X)
Hypomesus transpacificus - delta smelt (T)

Oncorhynchus mykiss – Critical habitat, Central Valley Steelhead (X) (NMFS)
Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)

Oncorhynchus tshawytscha - Central Valley spring-run Chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Ambystoma californiense - California tiger salamander, central population (T)

Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds
Haliaeetus leucocephalus - bald eagle (T)

Mammals

Plants

Proposed Species

Amphibians

Reptiles

Candidate Species

Fish
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)

ISELTON (480A)

Listed Species

Invertebrates
Branchinecta conservatio - Conservancy fairy shrimp (E)

Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Elaphrus viridis - Delta green ground beetle (T)

Lepidurus packardi – Vernal pool tadpole shrimp

Fish
Hypomesus transpacificus - Critical habitat, delta smelt (X).
Hypomesus transpacificus –Delta smelt (T)

Oncorhynchus mykiss – Critical habitat, Central Valley steelhead (X) (NMFS)
Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)

Oncorhynchus tshawytscha – Critical habitat, Central Valley spring-run Chinook salmon (X) (NMFS)
Oncorhynchus tshawytscha - Central Valley spring-run Chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha – Critical habitat, Central Valley winter-run Chinook salmon (X) (NMFS)
Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Ambystoma californiense - California tiger salamander, central population (T)

Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds
Haliaeetus leucocephalus - bald eagle (T)

Rallus longirostris obsoletus - California clapper rail (E)

Mammals

Proposed Species

Amphibians

Reptiles

Candidate Species

Fish
Oncorhynchus tshawytscha - Critical habitat, Central Valley fall/late fall-run Chinook (C) (NMFS)
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)

RIO VISTA (480B)

Listed Species

Invertebrates
Branchinecta conservation - Conservancy fairy shrimp (E)

Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Elaphrus viridis - delta green ground beetle (T)

Lepidurus packardi - vernal pool tadpole shrimp (E)

Fish
Hypomesus transpacificus - Critical habitat, delta smelt (X)
Hypomesus transpacificus - delta smelt (T)

Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)
Oncorhynchus mykiss - Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha - Central Valley spring-run Chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha - Critical Habitat, Central Valley spring-run Chinook (X) (NMFS)
Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Ambystoma californiense - California tiger salamander, central population (T)

Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds
Haliaeetus leucocephalus - bald eagle (T)

Rallus longirostris obsoletus - California clapper rail (E)

Candidate Species

Fish
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)
Oncorhynchus tshawytscha - Critical habitat, Central Valley fall/late fall-run Chinook (C) (NMFS)

JERSEY ISLAND (480C)

Listed Species

Invertebrates
Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Elaphrus viridis - delta green ground beetle (T)

Lepidurus packardi - vernal pool tadpole shrimp (E)

Fish
Hypomesus transpacificus - Critical habitat, delta smelt (X)
Hypomesus transpacificus - delta smelt (T)

Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)
Oncorhynchus mykiss - Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha - Critical habitat, winter-run Chinook salmon (X) (NMFS)
Oncorhynchus tshawytscha - Central Valley spring-run Chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha - Critical Habitat, Central Valley spring-run Chinook (X) (NMFS)
Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Ambystoma californiense - California tiger salamander, central population (T)

Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds
Haliaeetus leucocephalus - bald eagle (T)

Rallus longirostris obsoletus - California clapper rail (E)

Plants
Oenothera deltoides ssp. *howellii* - Antioch Dunes evening-primrose (E)

Candidate Species
Fish
Oncorhynchus tshawytscha - Critical habitat, Central Valley fall/late fall-run Chinook (C) (NMFS)
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)

BOULDIN ISLAND (48OD)

Listed Species

Invertebrates
Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Lepidurus packardi - vernal pool tadpole shrimp (E)

Fish
Hypomesus transpacificus - Critical habitat, delta smelt (X)
Hypomesus transpacificus - delta smelt (T)

Oncorhynchus mykiss – Critical habitat, Central Valley steelhead (X) (NMFS)
Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)

Oncorhynchus tshawytscha –Critical habitat, Central Valley spring-run Chinook salmon (X) (NMFS)
Oncorhynchus tshawytscha - Central Valley spring-run Chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Ambystoma californiense - California tiger salamander, central population (T)

Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds
Haliaeetus leucocephalus - bald eagle (T)

Rallus longirostris obsoletus - California clapper rail (E)

Mammals

Candidate Species

Fish
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)
Oncorhynchus tshawytscha - Critical habitat, Central Valley fall/late fall-run Chinook (C) (NMFS)

FLORIN (496B)

Listed Species

Invertebrates
Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Lepidurus packardi - vernal pool tadpole shrimp (E)

Fish
Hypomesus transpacificus - Critical habitat, delta smelt (X)
Hypomesus transpacificus - delta smelt (T)

Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)

Oncorhynchus tshawytscha - Central Valley spring-run Chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Ambystoma californiense - California tiger salamander, central population (T)

Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds
Haliaeetus leucocephalus - bald eagle (T)

Mammals

Candidate Species

Fish
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)

Oncorhynchus tshawytscha - Critical habitat, Central Valley fall/late fall-run Chinook (C) (NMFS)

BRUCEVILLE (496 C)

Listed Species

Invertebrates
Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Lepidurus packardi - vernal pool tadpole shrimp (E)

Fish
Hypomesus transpacificus - Critical habitat, delta smelt (X)
Hypomesus transpacificus - Delta smelt (T)

Oncorhynchus mykiss - Critical habitat, Central Valley steelhead (X) (NMFS)
Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)

Oncorhynchus tshawytscha - Central Valley spring-run Chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Ambystoma californiense - California tiger salamander, central population (T)

Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds
Haliaeetus leucocephalus - bald eagle (T)

Mammals

Plants

Proposed Species

Plants

Candidate Species

Fish
Oncorhynchus tshawytscha - Critical habitat, Central Valley fall/late fall-run Chinook (C) (NMFS)
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)

CLARKSBURG (497A)

Listed Species

Invertebrates
Branchinecta conservation - Conservancy fairy shrimp (E)

Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Lepidurus packardi - vernal pool tadpole shrimp (E)

Fish
Hypomesus transpacificus - Critical habitat, delta smelt (X)
Hypomesus transpacificus - delta smelt (T)

Oncorhynchus mykiss – Critical habitat, Central Valley steelhead (X) (NMFS)
Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)

Oncorhynchus tshawytscha –Critical habitat, Central Valley spring-run Chinook salmon (X) (NMFS)
Oncorhynchus tshawytscha - Central Valley spring-run Chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha – Critical habitat, winter-run Chinook salmon, Sacramento River (X) (NMFS)
Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Ambystoma californiense - California tiger salamander, central population (T)

Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds
Haliaeetus leucocephalus - bald eagle (T)

Rallus longirostris obsoletus - California clapper rail (E)

Mammals

Candidate Species

Fish
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)
Oncorhynchus tshawytscha - Critical habitat, Central Valley fall/late fall-run Chinook (C) (NMFS)

SAXON (497B)

Listed Species

Invertebrates
Branchinecta conservatio - Conservancy fairy shrimp (E)

Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Lepidurus packardi - vernal pool tadpole shrimp (E)

Fish
Hypomesus transpacificus - Critical habitat, delta smelt (X)
Hypomesus transpacificus - delta smelt (T)

Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)
Oncorhynchus mykiss – Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha - Central Valley spring-run Chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha – Critical habitat, Central Valley spring-run Chinook salmon (X) (NMFS)
Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Ambystoma californiense - California tiger salamander, central population (T)

Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds
Haliaeetus leucocephalus - bald eagle (T)

Mammals

Plants
Neostapfia colusana – Critical habitat, Colousa grass (X)
Neostapfia colusana – Colousa grass (T)

Tuctoria mucronata – Critical habitat, Solano grass (X)
Tuctoria mucronata – Solano grass (X)

Candidate Species

Fish
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)

Oncorhynchus tshawytscha - Critical habitat, Central Valley fall/late fall-run Chinook (C) (NMFS)

LIBERTY ISLAND (497C)

Listed Species

Invertebrates
Branchinecta conservatio - Conservancy fairy shrimp (E)

Branchinecta lynchi – Vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Elaphrus viridis - delta green ground beetle (T)

Lepidurus packardi – Vernal pool tadpole shrimp (E)

Fish
Hypomesus transpacificus - Critical habitat, delta smelt (X)
Hypomesus transpacificus - delta smelt (T)

Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)
Oncorhynchus mykiss - Critical habitat, Central Valley steelhead (X) (NMFS)

*Oncorhynchus tshawytsch*a - Critical habitat, spring-run Chinook salmon (X) (NMFS)
*Oncorhynchus tshawytsch*a - Central Valley spring-run Chinook salmon (T) (NMFS)
*Oncorhynchus tshawytsch*a - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Ambystoma californiense - California tiger salamander, central population (T)

Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds
Haliaeetus leucocephalus - bald eagle (T)

Mammals

Plants

Proposed Species

Amphibians

Candidate Species

Fish

Oncorhynchus tshawytscha - Critical habitat, Central Valley fall/late fall-run Chinook (C) (NMFS)
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)

COURTLAND (497D)

Listed Species

Invertebrates
Branchinecta conservatio - Conservancy fairy shrimp (E)

Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Elaphrus viridis - delta green ground beetle (T)

Lepidurus packari - vernal pool tadpole shrimp (E)

Fish
Hypomesus transpacificus - Critical habitat, delta smelt (X)
Hypomesus transpacificus - delta smelt (T)

Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)
Oncorhynchus mykiss - Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha - Central Valley spring-run Chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha - Critical Habitat, Central Valley spring-run Chinook (X) (NMFS)
Oncorhynchus tshawytscha - Critical habitat, winter-run Chinook salmon (X) (NMFS)
Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Ambystoma californiense - California tiger salamander, central population (T)

Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds
Haliaeetus leucocephalus - bald eagle (T)

Mammals

Plants

Candidate Species

Fish

Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)
Oncorhynchus tshawytscha - Critical habitat, Central Valley fall/late fall-run Chinook (C) (NMFS)

RIO LINDA (512B)

Listed Species

Invertebrates
Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Lepidurus packardi - vernal pool tadpole shrimp (E)

Fish
Hypomesus transpacificus - delta smelt (T)

Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)
Oncorhynchus mykiss - Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha - Central Valley spring-run Chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Ambystoma californiense - California tiger salamander, central population (T)

Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds
Haliaeetus leucocephalus - bald eagle (T)

Candidate Species

Fish
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)

SACRAMENTO EAST (512C)

Listed Species

Invertebrates
Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus – Critical habitat, valley elderberry longhorn beetle (X)
Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Lepidurus packari - vernal pool tadpole shrimp (E)

Fish
Hypomesus transpacificus - Critical habitat, delta smelt (X)
Hypomesus transpacificus - delta smelt (T)

Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)
Oncorhynchus mykiss - Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha - Central Valley spring-run Chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha - Critical Habitat, Central Valley spring-run Chinook (X) (NMFS)
Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Ambystoma californiense - California tiger salamander, central population (T)

Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds
Haliaeetus leucocephalus - bald eagle (T)

Mammals

Plants

Candidate Species

Fish
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)

TAYLOR MONUMENT (513A)

Listed Species

Invertebrates
Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Lepidurus packari - vernal pool tadpole shrimp (E)

Fish
Hypomesus transpacificus - delta smelt (T)

Oncorhynchus mykiss - Critical habitat, Central Valley steelhead (X) (NMFS)
Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)

Oncorhynchus tshawytscha – Critical habitat, Central Valley spring-run Chinook salmon (X) (NMFS)
Oncorhynchus tshawytscha - Central Valley spring-run Chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha – Critical habitat, winter-run Chinook salmon, Sacramento River (X) (NMFS)
Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Ambystoma californiense - California tiger salamander, central population (T)

Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds
Haliaeetus leucocephalus - bald eagle (T)

Mammals

Plants

Candidate Species

Fish
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)
Oncorhynchus tshawytscha – Critical habitat, Central Valley fall/late fall-run Chinook salmon (C) (NMFS)

Birds
Coccyzus americanus occidentalis – Western yellow-billed cuckoo (C)

GRAYS BEND (513B)

Listed Species

Invertebrates
Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Lepidurus packardi - vernal pool tadpole shrimp (E)

Fish
Hypomesus transpacificus - delta smelt (T)

Oncorhynchus mykiss - Critical habitat, Central Valley steelhead (X) (NMFS)
Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)

Oncorhynchus tshawytscha – Critical habitat, Central Valley spring-run Chinook salmon (X) (NMFS)
Oncorhynchus tshawytscha - Central Valley spring-run Chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha – Critical habitat, winter-run Chinook salmon, Sacramento River (X) (NMFS)
Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Ambystoma californiense - California tiger salamander, central population (T)

Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds
Charadrius alexandrinus nivosus – Western snowy plover (T)

Haliaeetus leucocephalus - bald eagle (T)

Mammals

Plants
Cordylanthus palmatus – Palmate-bracted bird's beak (E)

Candidate Species

Fish
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)
Oncorhynchus tshawytscha – Critical habitat, Central Valley fall/late fall-run Chinook salmon (C) (NMFS)

Birds
Coccyzus americanus occidentalis – Western yellow-billed cuckoo (C).

DAVIS (513C)

Listed Species

Invertebrates
Branchinecta conservatio - Conservancy fairy shrimp (E)

Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Lepidurus packardi – Critical habitat, vernal pool tadpole shrimp (X)
Lepidurus packardi - vernal pool tadpole shrimp (E)

Fish
Hypomesus transpacificus - delta smelt (T)

Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)

Oncorhynchus tshawytscha - Central Valley spring-run Chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Ambystoma californiense - California tiger salamander, central population (T)

Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds
Charadrius alexandrinus nivosus – Western snowy plover (T)

Haliaeetus leucocephalus - bald eagle (T)

Mammals

Plants
Nostapfia colusana – Critical habitat, Colusa grass (X)

Tuctoria mucronata – Critical habitat, Solano grass (X)

Candidate Species

Fish
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)

Birds

SACRAMENTO WEST (513D)

Listed Species

Invertebrates
Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Lepidurus packari - vernal pool tadpole shrimp (E)

Fish
Hypomesus transpacificus - Critical habitat, delta smelt (X)
Hypomesus transpacificus - delta smelt (T)

Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)
Oncorhynchus mykiss - Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha - Central Valley spring-run Chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha - Critical Habitat, Central Valley spring-run Chinook (X) (NMFS)
Oncorhynchus tshawytscha – Critical habitat, winter-run Chinook salmon, Sacramento River (X) (NMFS)
Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Ambystoma californiense - California tiger salamander, central population (T)

Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds
Haliaeetus leucocephalus - bald eagle (T)

Mammals

Plants

Candidate Species

Fish
Oncorhynchus tshawytscha – Critical habitat, Central Valley fall/late fall-run Chinook salmon (C) (NMFS)
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)

SHERIDAN (528B)

Listed Species

Invertebrates
Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Lepidurus packari - vernal pool tadpole shrimp (E)

Fish
Hypomesus transpacificus - delta smelt (T)

Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)
Oncorhynchus mykiss - Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha - Central Valley spring-run Chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds
Haliaeetus leucocephalus - bald eagle (T)

Mammals

Plants

Candidate Species

Birds

Fish
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)
Oncorhynchus tshawytscha –Critical habitat, Central Valley fall/late fall-run Chinook salmon (C) (NMFS)

PLEASANT GROVE (528C)

Listed Species

Invertebrates
Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Lepidurus packari - vernal pool tadpole shrimp (E)

Fish
Hypomesus transpacificus - delta smelt (T)

Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)
Oncorhynchus mykiss - Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha - Central Valley spring-run Chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds
Haliaeetus leucocephalus - bald eagle (T)

Mammals

Plants

Candidate Species

Birds
Coccyzus americanus occidentalis – Western yellow-billed cuckoo (C)

Fish
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)

NICOLAUS (529A)

Listed Species

Invertebrates
Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Lepidurus packari - vernal pool tadpole shrimp (E)

Fish
Hypomesus transpacificus - delta smelt (T)

Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)
Oncorhynchus mykiss - Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha - Central Valley spring-run Chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha – Critical habitat, Central Valley spring-run Chinook salmon (X) (NMFS)
Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Rana aurora draytonii - California red-legged frog (T)

Reptiles

Thamnophis gigas - giant garter snake (T)

Birds
Haliaeetus leucocephalus - bald eagle (T)

Mammals

Plants

Candidate Species

Birds
Coccyzus americanus occidentalis – Western yellow-billed cuckoo (C)

Fish
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)
Oncorhynchus tshawytscha –Critical habitat, Central Valley fall/late fall-run Chinook salmon (C) (NMFS)

SUTTER CAUSEWAY (529B)

Listed Species

Invertebrates
Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Lepidurus packari - vernal pool tadpole shrimp (E)

Fish
Hypomesus transpacificus - delta smelt (T)

Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)
Oncorhynchus mykiss - Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha - Central Valley spring-run Chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha – Critical habitat, Central Valley spring-run Chinook salmon (X) (NMFS)
Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Ambystoma californiense - California tiger salamander, central population (T)

Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds
Haliaeetus leucocephalus - bald eagle (T)

Mammals

Plants

Candidate Species

Birds
Coccyzus americanus occidentalis – Western yellow-billed cuckoo (C)

Fish
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)
Oncorhynchus tshawytscha –Critical habitat, Central Valley fall/late fall-run Chinook salmon (C) (NMFS)

KNIGHTS LANDING (529C)

Listed Species

Invertebrates
Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Lepidurus packari - vernal pool tadpole shrimp (E)

Fish
Hypomesus transpacificus - delta smelt (T)

Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)
Oncorhynchus mykiss - Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha - Central Valley spring-run Chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha - Critical Habitat, Central Valley spring-run Chinook (X) (NMFS)
Oncorhynchus tshawytscha – Critical habitat, winter-run Chinook salmon, Sacramento River (X) (NMFS)

Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Ambystoma californiense - California tiger salamander, central population (T)

Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds
Haliaeetus leucocephalus - bald eagle (T)

Mammals

Plants

Candidate Species

Birds
Coccyzus americanus occidentalis – Western yellow-billed cuckoo (C)

Fish
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)
Oncorhynchus tshawytscha –Critical habitat, Central Valley fall/late fall-run Chinook salmon (C) (NMFS)

VERONA (529D)

Listed Species

Invertebrates
Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Lepidurus packari - vernal pool tadpole shrimp (E)

Fish
Hypomesus transpacificus - delta smelt (T)

Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)
Oncorhynchus mykiss - Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha - Central Valley spring-run Chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha - Critical Habitat, Central Valley spring-run Chinook (X) (NMFS)
Oncorhynchus tshawytscha - Critical habitat, winter-run Chinook salmon, Sacramento River (X) (NMFS)
Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Ambystoma californiense - California tiger salamander, central population (T)

Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds

Haliaeetus leucocephalus - bald eagle (T)

Mammals

Plants

Candidate Species

Birds
Coccyzus americanus occidentalis – Western yellow-billed cuckoo (C)

Fish
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)
Oncorhynchus tshawytscha –Critical habitat, Central Valley fall/late fall-run Chinook salmon (C) (NMFS)

County Lists

Sacramento County

Listed Species

Invertebrates
Branchinecta conservatio - Conservancy fairy shrimp (E)

Branchinecta lynchi - Critical habitat, vernal pool fairy shrimp (X)
Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - Critical habitat, valley elderberry longhorn beetle (X)
Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Elaphrus viridis delta green ground beetle (T)

Lepidurus packardi - Critical habitat, vernal pool tadpole shrimp (X)
Lepidurus packardi - vernal pool tadpole shrimp (E)

Fish
Hypomesus transpacificus - Critical habitat, delta smelt (X)
Hypomesus transpacificus - delta smelt (T)

Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)
Oncorhynchus mykiss - Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha - Central Valley spring-run Chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha - Critical Habitat, Central Valley spring-run Chinook (X) (NMFS)
Oncorhynchus tshawytscha - Critical habitat, winter-run Chinook salmon (X) (NMFS)
Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Ambystoma californiense - California tiger salamander, central population (T)
Ambystoma californiense - Critical habitat, CA tiger salamander, central population (X)

Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds
Haliaeetus leucocephalus - bald eagle (T)

Plants
Castilleja campestris ssp. *succulenta* - Critical habitat, succulent (=fleshy) owl's-clover (X)

Oenothera deltoides ssp. *howelli* - Antioch Dunes evening-primrose (E)

Orcuttia tenuis - Critical habitat, slender Orcutt grass (X)
Orcuttia tenuis - slender Orcutt grass (T)

Orcuttia viscida - Critical habitat, Sacramento Orcutt grass (X)
Orcuttia viscida - Sacramento Orcutt grass (E)

Candidate Species

Fish
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)
Oncorhynchus tshawytscha - Critical habitat, Central Valley fall/late fall-run Chinook (C) (NMFS)

Birds
Coccyzus americanus occidentalis - Western yellow-billed cuckoo (C)

Sutter County

Listed Species

Invertebrates
Branchinecta conservatio - Conservancy fairy shrimp (E)

Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Lepidurus packardi - vernal pool tadpole shrimp (E)

Fish
Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)
Oncorhynchus mykiss - Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha - Central Valley spring-run Chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha - Critical Habitat, Central Valley spring-run Chinook (X) (NMFS)

Oncorhynchus tshawytscha - Critical habitat, winter-run Chinook salmon (X) (NMFS)
Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Ambystoma californiense - California tiger salamander, central population (T)

Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds
Haliaeetus leucocephalus - bald eagle (T)

Plants
Castilleja campestris ssp. *succulenta* - Critical habitat, succulent (=fleshy) owl's-clover (X)

Oenothera deltoides ssp. *howelli* - Antioch Dunes evening-primrose (E)

Orcuttia tenuis - Critical habitat, slender Orcutt grass (X)
Orcuttia tenuis - slender Orcutt grass (T)

Orcuttia viscida - Critical habitat, Sacramento Orcutt grass (X)
Orcuttia viscida - Sacramento Orcutt grass (E)

Candidate Species

Fish
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)
Oncorhynchus tshawytscha - Critical habitat, Central Valley fall/late fall-run Chinook (C) (NMFS)

Birds
Coccyzus americanus occidentalis - Western yellow-billed cuckoo (C)

Yolo County

Listed Species

Invertebrates
Branchinecta conservatio - Conservancy fairy shrimp (E)

Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Lepidurus packardi - Critical habitat, vernal pool tadpole shrimp (X)
Lepidurus packardi - vernal pool tadpole shrimp (E)

Fish
Hypomesus transpacificus - Critical habitat, delta smelt (X)

Hypomesus transpacificus - delta smelt (T)

Oncorhynchus mykiss - Central Valley steelhead (T) (NMFS)
Oncorhynchus mykiss - Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha - Central Valley spring-run Chinook salmon (T) (NMFS)
Oncorhynchus tshawytscha - Critical Habitat, Central Valley spring-run Chinook (X) (NMFS)
Oncorhynchus tshawytscha - Critical habitat, winter-run Chinook salmon (X) (NMFS)
Oncorhynchus tshawytscha - winter-run Chinook salmon, Sacramento River (E) (NMFS)

Amphibians
Ambystoma californiense - California tiger salamander, central population (T)
Ambystoma californiense - Critical habitat, CA tiger salamander, central population (X)

Rana aurora draytonii - California red-legged frog (T)

Reptiles
Thamnophis gigas - giant garter snake (T)

Birds
Haliaeetus leucocephalus - bald eagle (T)

Strix occidentalis caurina - Notrhern spotted owl (T)

Plants
Cordylanthus palmatus - Palmate-bracted bird's beak (E)

Neostapfia colusana - Critical habitat, Colusa grass (X)
Neostapfia colusana - Colusa grass (T)

Tuctoria mucronata – Critical habitat, Solano grass (X)
Tuctoria mucronata – Solano grass (X)

Candidate Species

Fish
Oncorhynchus tshawytscha - Central Valley fall/late fall-run Chinook salmon (C) (NMFS)
Oncorhynchus tshawytscha - Critical habitat, Central Valley fall/late fall-run Chinook (C) (NMFS)

Birds
Coccyzus americanus occidentalis - Western yellow-billed cuckoo (C)

Key:

- (E) Endangered - Listed as being in danger of extinction.
- (T) Threatened - Listed as likely to become endangered within the foreseeable future.
- (P) Proposed - Officially proposed in the Federal Register for listing as endangered or threatened.
- (NMFS) Species under the Jurisdiction of the National Oceanic & Atmospheric Administration Fisheries Service. Consult with them directly about these species.
- Critical Habitat - Area essential to the conservation of a species.

- (PX) Proposed Critical Habitat - The species is already listed. Critical habitat is being proposed for it.
- (C) Candidate - Candidate to become a proposed species.
- (V) Vacated by a court order. Not currently in effect. Being reviewed by the Service.
- (X) Critical Habitat designated for this species

Appendix B

Special-Status Species with the Potential to Occur in the Project Area

Table B-1. Special-status species with the potential to occur in the Project area.

Species	Status[1] Federal/ State/ CNPS/ Other	Distribution	Habitat association	Potential occurrence by site (RM)[2]								Likelihood of occurrence in the Project area
				16.9L	19.4R, 19.0R	33.3R, 33.0R, 22.7R	48.2R, 47.9R, 44.7R, 43.7R	47.0L	62.5R	68.9L	78.0L	
Invertebrates												
Antioch Dunes anthicid beetle *Anthicus anthiochensis*	SC/–/–/–	Population in Antioch Dunes believed extinct; now known only from Grand Island and in and around Sandy Beach County Park, Sacramento County.	Loose sand on sand bars and sand dunes.	CNDDB	CNDDB	CNDDB					CNDDB	Outside the species' known range. No suitable habitat in the Project area.
Conservancy fairy shrimp *Branchinecta conservatio*	E/–/–/–	Disjunct occurrences in Solano, Merced, Tehama, Ventura, Butte, and Glenn counties.	Large, deep vernal pools in annual grasslands.	USFWS	USFWS	CNDDB, USFWS	CNDDB, USFWS	CNDDB, USFWS	CNDDB, USFWS	USFWS		No suitable habitat in the Project area.
Delta green ground beetle *Elapharus viridus*	T/–/–/–	Restricted to Olcott Lake and other vernal pools at Jepson Prairie Preserve, Solano County.	Sparsely vegetated edges of vernal lakes and pools; occur up to 250 feet from pools.	USFWS	USFWS	USFWS	USFWS	USFWS				No suitable habitat in the Project area.
Mid-valley fairy shrimp *Brachinecta* sp. *Amid-valley*	SC/–/–/–	California's Central Valley.	Vernal pools in annual grasslands.			CNDDB	CNDDB	CNDDB	CNDDB			No suitable habitat in the Project area.
Curved-foot hygrotus diving beetle *Hygrotus curvipes*	SC/–/–/–	Eastern Contra Costa County and the Alameda watershed.	Inhabits alkali vernal pools and other seasonal wetlands or slow-moving streams with pools and fringed with alkali vegetation between the Outer Coast Range and Sacramento Delta.	CNDDB	CNDDB							No suitable habitat in the Project area.
Ricksecker's water scavenger beetle *Hydrochara rickseckeri*	SC/–/–/–	San Francisco Bay Area including Marin, Sonoma, Alameda, and Contra Costa counties.	Inhabits seasonally ponded wetlands in the San Francisco Bay area.	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB				No suitable habitat in the Project area.

Table B-1 Continued

Species	Status[1] Federal/ State/ CNPS/ Other	Distribution	Habitat association	Potential occurrence by site (RM)[2]								Likelihood of occurrence in the Project area
				16.9L	19.4R, 19.0R	33.3R, 33.0R, 22.7R	48.2R, 47.9R, 44.7R, 43.7R	47.0L	62.5R	68.9L	78.0L	
Sacramento anthicid beetle *Anthicus sacramento*	SC/–/–/–	Dune areas at mouth of Sacramento River; western tip of Grand Island, Sacramento County; upper Putah Creek and dunes near Rio Vista, Solano County; Ord Ferry Bridge, Butte County.	Found in sand slip-faces among willows; associated with riparian and other aquatic habitats.	CNDDB	CNDDB						CNDDB	No suitable habitat in the Project area.
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus* And Critical habitat	T/–/–/–	Streamside habitats below 3,000 feet throughout the Central Valley.	Riparian and oak savanna habitats with elderberry shrubs; elderberries are the host plant.	CNDDB, USFWS	CNDDB, USFWS	CNDDB, USFWS	CNDDB, USFWS	CNDDB, USFWS	CNDDB, USFWS	CNDDB, USFWS	CNDDB, USFWS	Within the species known range. Suitable habitat (Valley elderberry shrubs) present at Sites RM 44.7R, 47.0L, 47.9R, and 48.2R.
Vernal pool fairy shrimp *Branchinecta lynchi*	T/–/–/–	Central Valley, central and south Coast Ranges from Tehama County to Santa Barbara County. Isolated populations also in Riverside County.	Vernal pools; also found in sandstone rock outcrop pools.	CNDDB, USFWS	NDDB, USFWS	CNDDB, USFWS	CNDDB, USFWS	CNDDB, USFWS	CNDDB, USFWS	CNDDB, USFWS	CNDDB, USFWS	No suitable habitat in the Project area.
Antioch andrenid bee *Perdita scitula antiochensis*	SC/–/–/–	Known only from Antioch dunes and Oakley.	Inhabits sand dunes or other loose, sand deposits with late summer and fall-flowering endemics, such as *Eriogonum* sp., *Gutierrezia* sp., *Californica* sp., *Heterotherca grandiflora*, *Lessingia glandulifera*	CNDDB	CNDDB	CNDDB						No suitable habitat in the Project area.
Vernal pool tadpole shrimp *Lepidurus packardi* And Critical Habitat	E/–/–/–	Shasta County south to Merced County.	Vernal pools and ephemeral stock ponds.	CNDDB, USFWS	CNDDB, USFWS	CNDDB, USFWS	CNDDB, USFWS	CNDDB , USFWS	CNDDB, USFWS	CNDDB, USFWS	CNDDB, USFWS	No suitable habitat in the Project area.

Table B-1 Continued

Species	Status[1] Federal/ State/ CNPS/ Other	Distribution	Habitat association	Potential occurrence by site (RM)[2]								Likelihood of occurrence in the Project area
				16.9L	19.4R, 19.0R	33.3R, 33.0R, 22.7R	48.2R, 47.9R, 44.7R, 43.7R	47.0L	62.5R	68.9L	78.0L	
Sacramento Valley Tiger Beetle *Cicindela hirticollis abrupta*	–/–/– /G5,TH, SH	Historical ranges include Feather, Sacramento, Yuba, American, San Joaquin, Mokulumne, and King Rivers. Recent surveys, data, and literature strongly supported the extinction of *C. h. abrupta.*	Extensive low bars or edges that provide near-surface moisture and sandy flood plain habitat near bodies of water. Requires fine to medium sand, terraced floodplains or low sandy water edge flats.				CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	Suitable habitat available at RM Sites RM 44.7R and 47.0L, although based on recent information, they are likely extinct from the Sacramento and Feather Rivers. As a result, not likely present in the Project area.
Antioch multilid wasp *Myrmosula pacifica*	–/–/– /G1, S1	Known only from the sand dunes at Antioch and San Joaquin Valley.	No habitat associations are known for this species.				CNDDB	CNDDB	CNDDB	CNDDB		Sources indicate species as extirpated or extinct due to lack of further collections. No suitable habitat in the Project area.
California linderiella *Linderiella occidentalis*	–/–/– /G2, G3, S2, S3	The California fairy shrimp is the most common fairy shrimp in the Central Valley. It has been documented on most land forms, geologic formations and soil types supporting vernal pools in California, at altitudes as high as 3800 feet above sea level.	Seasonal pools in unpowered grasslands with old alluvial soils underplain by hardpan or in sandstone depressions water in the pools has very low alkalinity, conductivity, and total dissolved solids.	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	No suitable habitat in the Project area.

Table B-1 Continued

Species	Status[1] Federal/ State/ CNPS/ Other	Distribution	Habitat association	Potential occurrence by site (RM)[2]								Likelihood of occurrence in the Project area
				16.9L	19.4R, 19.0R	33.3R, 33.0R, 22.7R	48.2R, 47.9R, 44.7R, 43.7R	47.0L	62.5R	68.9L	78.0L	
Fish												
Sacramento River winter-run Chinook salmon *Oncorhynchus tshawytscha* And Critical habitat	E/CE/–/–	Sacramento River and San Joaquin Estuary	Mainstem river reaches with cool water and available spawning gravel; rear five to ten months in the river and estuary; migrate to the ocean to feed and grow until sexually mature.	NMFS; USFWS	NMFS; USFWS	NMFS; USFWS	NMFS; USFWS	NMFS; USFWS	NMFS; USFWS	NMFS; USFWS	NMFS; USFWS	Within the species known range. Rearing and migratory habitat present in the Project area.
Spring-run Chinook salmon *Oncorhynchus tshawytscha* And Crtical habitat	T/CT/–/–	Central Valley Spring-run includes populations spawning in the Sacramento River and its tributaries (Deer, Mill, Antelope, Battle, Beegum, Butte, and Big Chico Creeks) and the Feather and Yuba Rivers.	Low- to mid-elevation rivers and streams with cold water, clean gravel of appropriate size for spawning and adequate rearing habitat; typically rear in fresh water for one or more years before migrating to the ocean.	NMFS; USFWS	NMFS; USFWS	NMFS; USFWS	NMFS; USFWS	NMFS; USFWS	NMFS; USFWS	NMFS; USFWS	NMFS; USFWS	Within the species known range. Rearing and migratory habitat present in the Project area.
Central Valley fall and late fall-run Chinook salmon *Oncorhynchus tshawytscha* And Critical Habitat	C/CSC/–/–	Sacramento, Feather and Yuba Rivers, Battle Cottonwood, Clear, and Mill creeks.	Low elevation mainstem rivers and tributaries with cool water, deep pools, and suitable spawning gravel; migrate to the ocean to feed and grow until sexually mature.	NMFS; USFWS	NMFS; USFWS	NMFS; USFWS	NMFS; USFWS	NMFS; USFWS	NMFS; USFWS	NMFS; USFWS	NMFS; USFWS	Within the species known range. Rearing and migratory habitat present in the Project area.
Central Valley steelhead *Oncorhynchus mykiss* And Critical Habitat	T/–/–/–	Sacramento River and its tributaries; San Joaquin River and its tributaries.	Rivers and streams with cold water, clean gravel of appropriate size for spawning, and suitable rearing habitat; typically rear in fresh water for one or more years before migrating to the ocean.	NMFS; USFWS	NMFS; USFWS	NMFS; USFWS	NMFS; USFWS	NMFS; USFWS	NMFS; USFWS	NMFS; USFWS	NMFS; USFWS	Within the species known range. Rearing and migratory habitat present in the Project area.

Table B-1 Continued

Species	Status[1] Federal/ State/ CNPS/ Other	Distribution	Habitat association	Potential occurrence by site (RM)[2]								Likelihood of occurrence in the Project area
				16.9L	19.4R, 19.0R	33.3R, 33.0R, 22.7R	48.2R, 47.9R, 44.7R, 43.7R	47.0L	62.5R	68.9L	78.0L	
Delta smelt *Hypomesus transpacificus* And Critical Habitat	T/CT/–/–	Lower reaches of Sacramento and Napa rivers. The Delta including Suisun Bay, Goodyear, Suisun, Cutoff, First Mallard, and Montezuma sloughs.	Estuarine or brackish waters up to 18 parts per thousand (ppt); spawn in shallow brackish water upstream of the mixing zone (zone of saltwater-freshwater interface) where salinity is around 2 ppt.	USFWS	USFWS	USFWS	USFWS	USFWS	USFWS	USFWS	USFWS	At the upper end of the species range. Only occasionally present.
Sacramento splittail *Pogonichthys macrolepidotus*	D/CSC/–/–	Lower portions of the Napa, Petaluma, Sacramento and San Joaquin rivers. Sacramento–San Joaquin Delta including Suisun Bay, Suisun Marsh.	Low elevation mainstem rivers and estuaries with low to moderate salinity (0-18 ppt); shallow, flooded vegetated habitat for spawning and foraging.	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	Within the species known range.
Green sturgeon *Acipenser medirostris*	T/CSC/–/–	Sacramento and Klamath rivers.	Large mainstem rivers with cool water and cobble, clean sand, or bedrock for spawning.	NMFS	NMFS	NMFS	NMFS	NMFS	NMFS	NMFS	NMFS	Within the species known range. Suitable habitat present in the Project area. May not be accounted for by USFWS or CNDDB data sources due to the recent federal listing on 7 April 2006.

Table B-1 Continued

Species	Status[1] Federal/ State/ CNPS/ Other	Distribution	Habitat association	Potential occurrence by site (RM)[2]								Likelihood of occurrence in the Project area
				16.9L	19.4R, 19.0R	33.3R, 33.0R, 22.7R	48.2R, 47.9R, 44.7R, 43.7R	47.0L	62.5R	68.9L	78.0L	
Sacramento perch *Archoplites interruptus*	–/CSC/–/–	Historically found throughout the Central Valley and low elevation rivers. Currently in their native, low elevation habitat, they exist in Clear Lake, Almeda Creek, Central Valley reservoirs, and farm ponds. Introduced into higher elevations, populations have established in reservoirs and the Klamath, Pit, Walker, Mono, and Owens River watersheds.	Rivers, lakes, reservoirs, and farm ponds with warm water, high turbidity, and beds of rooted, submerged, and emergent vegetation.	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	Found in Lake Greenhaven (Brickyard Pond) in 1970s, although not expected to currently inhabit the pond. Recent surveys have not documented Sacramento perch in the Sacramento River; unlikely to occur in the Project area (Patrick Crain, UC Davis, California, pers. comm., April 2006).
Amphibians												
California red-legged frog *Rana draytonii*	T/CSC/–/–	Found along the coast and coastal mountain ranges of California from Marin County to San Diego County and in the Sierra Nevada from Tehama County to Fresno County.	Permanent and semipermanent aquatic habitats, such as creeks and cold-water ponds, with emergent and submergent vegetation. May aestivate in rodent burrows or cracks during dry periods.	USFWS	USFWS	USFWS	USFWS	USFWS	USFWS	USFWS	USFWS	No suitable habitat in the Project area.
California tiger salamander *Ambystoma californiense*	CS/CSC/–/–	Central Valley, including Sierra Nevada foothills, up to approximately 1,000 feet, and coastal region from Butte County south to northeastern San Luis Obispo County.	Small ponds, lakes, or vernal pools in grasslands and oak woodlands for larvae; rodent burrows, rock crevices, or fallen logs for cover for adults and for summer dormancy.	USFWS	USFWS	USFWS	USFWS	USFWS	USFWS	USFWS	USFWS	No suitable habitat in the Project area.

Table B-1 Continued

Species	Status[1] Federal/ State/ CNPS/ Other	Distribution	Habitat association	Potential occurrence by site (RM)[2]								Likelihood of occurrence in the Project area
				16.9L	19.4R, 19.0R	33.3R, 33.0R, 22.7R	48.2R, 47.9R, 44.7R, 43.7R	47.0L	62.5R	68.9L	78.0L	
Western spadefoot *Spea hammondii*	–/–/– /G3, S3	Historically ranged from Redding to northwestern Baja California. Currently their range includes the Central Valley and associated foothills, eastern edge of the Coast Range, and south of San Francisco Bay.	Occurs primarily in grasslands habitats, but can be found in valley-foothill hardwood woodlands. Vernal pools are essential for breeding and egg-laying. In areas where natural pools are rare or nonexistent artificial impoundments such as stock tanks and pools that form at the base of road and railroad grades have aloowed colonization.							CNDDB	CNDDB	No suitable habitat in the Project area.
Reptiles												
Giant garter snake *Thamnophis gigas*	T/CT/– /–	Central Valley from the vicinity of Burrel in Fresno County north to near Chico in Butte County; has been extirpated from areas south of Fresno.	Sloughs, canals, low-gradient streams and freshwater marsh habitats where there is a prey base of small fish and amphibians; also found in irrigation ditches and rice fields; requires grassy banks and emergent vegetation for basking and areas of high ground protected from flooding during winter.	CNDDB, USFWS	CNDDB, USFWS	CNDDB, USFWS	CNDDB, USFWS	CNDDB, USFWS	CNDDB, USFWS	CNDDB, USFWS	CNDDB, USFWS	No suitable habitat in the Project area (pers comm. Kim Turrner, Biologist, USFWS.
Silvery legless lizard *Anniella pulchra pulchra*	SC/CSC /–/–	Along the Coast, Transverse, and Peninsular ranges from Contra Costa County to San Diego County with spotty occurrences in the San Joaquin Valley.	Habitats with loose soil for burrowing or thick duff or leaf litter; often forages in leaf litter at plant bases; may be found on beaches, sandy washes, and in woodland, chaparral, and riparian areas.	CNDDB	CNDDB							Outside the species' known range. No suitable habitat in the Project area.

Table B-1 Continued

Species	Status[1] Federal/ State/ CNPS/ Other	Distribution	Habitat association	Potential occurrence by site (RM)[2]								Likelihood of occurrence in the Project area
				16.9L	19.4R, 19.0R	33.3R, 33.0R, 22.7R	48.2R, 47.9R, 44.7R, 43.7R	47.0L	62.5R	68.9L	78.0L	
Western pond turtle *Clemmys marmorata*	SC/CSC /–/–	Northwestern subspecies occurs from the Oregon border of Del Norte and Siskiyou Counties south along the coast to San Francisco Bay, inland through the Sacramento Valley, and on the western slope of Sierra Nevada. Southwestern subspecies occurs along the central coast of California east to the Sierra Nevada and along the southern California coast inland to the Mojave and Sonora Deserts; range overlaps with that of the northwestern pond turtle throughout the Delta and in the Central Valley.	Occupies ponds, marshes, pools in slow-flowing rivers, streams, and irrigation canals with muddy or rocky bottoms and with watercress, cattails, water lilies, or other aquatic vegetation in woodlands, grasslands, and open forests.	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	Suitable habitat present in the Project area at Sites RM 19.0R, 22.7R, 43.7R, and 44.7R.
Birds												
Great egret rookery *Ardea alba*	–/–/– /G5, S4	Breeding locations documented along the Klamath River, Tule and Clear Lake, Humboldt County, San Francisco Bay, and scattered locations in the Central Valley.	Colonial nester in large trees located near marshes, tide-flats, irrigated pastures and margins of rivers and lakes. Can be found in coastal lagoons, tidal saltwater marshes and mudflats, bays, estuaries, margins of large rivers and lakes, freshwater marshes, irrigation canals and flooded fields.			CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	Suitable habitat exists in the Project area, although the species was not observed during field surveys.

Table B-1 Continued

Species	Status[1] Federal/ State/ CNPS/ Other	Distribution	Habitat association	Potential occurrence by site (RM)[2]								Likelihood of occurrence in the Project area
				16.9L	**19.4R, 19.0R**	**33.3R, 33.0R, 22.7R**	**48.2R, 47.9R, 44.7R, 43.7R**	**47.0L**	**62.5R**	**68.9L**	**78.0L**	
Great blue heron Rookery *Ardea herodias*	–/–/–/ G5, S4	Occurs throughout the state and is widespread. Breeding locations documented in northern California include the Klamath River, Tule Lake, and throughout the Central, Sacramento, and San Joaquin valleys. Extends south to San Diego, Riverside, and the Imperial Valley.	Colonial nester in groves of trees, cliffsides, and sequestered spots on marshes in close proximity to foraging areas. Often in mixed colonies with great egrets	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	Suitable habitat exists in the Project area, although the species was not observed during field surveys.
Bald eagle *Haliaeetus leucocephalus*	T, PR/CE, FP/–	Nests in Siskiyou, Modoc, Trinity, Shasta, Lassen, Plumas, Butte, Tehama, Lake, and Mendocino counties and in the Lake Tahoe basin. Reintroduced into central coast. Winter range includes the rest of California, except the southeastern deserts, very high altitudes in the Sierra Nevada, and east of the Sierra Nevada south of Mono County.	In western North America, nests and roosts in coniferous forests within 1 mile of a lake, reservoir, stream, or the ocean.	USFWS	USFWS	USFWS	USFWS	USFWS	USFWS	USFWS	USFWS	May occur in the Project area during migration or winter. No suitable nesting habitat in the Project area.
Bank swallow *Riparia riparia*	SC/CT/– /–	Occurs along the Sacramento River from Tahama County to Sacramento County, along the Feather and lower American Rivers, in the Owens Valley; and in the plains east of the Cascade Range in Modoc, Lassen, and northern Siskiyou Counties. Small populations near the coast from San Francisco County to Monterey County.	Nests in bluffs or banks, usually adjacent to water, where the soil consists of sand or sandy loam.	CNDDB	CNDDB		CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	No suitable roosting habitat in the Project area.

Table B-1 Continued

Species	Status[1] Federal/ State/ CNPS/ Other	Distribution	Habitat association	Potential occurrence by site (RM)[2]								Likelihood of occurrence in the Project area
				16.9L	19.4R, 19.0R	33.3R, 33.0R, 22.7R	48.2R, 47.9R, 44.7R, 43.7R	47.0L	62.5R	68.9L	78.0L	
Black crowned night heron Rookery *Nycticorax nycticorax*	–/–/–/G5, S4	Rookeries observed from the Oregon border south throughout the central valley, Sierra and Cascade Mountains, eastern deserts, San Diego, and Imperial county. In northwest California restricted, to coastal slopes of Del Norte and Humboldt County.	Rookery sites usually located in densely vegetated trees and occasionally in tule patches adjacent to foraging areas, lake margins, mud-bordered bays, and marshy spots. Known to nest in association with snowy egrets in low dead trees and bushes near water.			CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	May occur in the Project area during migration or winter. No suitable nesting habitat in the Project area.
California black rail *Laterallus jamaicensis coturniculus*	SC/CT, FP/–/–	Permanent resident in the San Francisco Bay and eastward through the Delta into Sacramento and San Joaquin Counties; small populations in Marin, Santa Cruz, San Luis Obispo, Orange, Riverside, and Imperial counties.	Tidal salt marshes associated with heavy growth of pickleweed; also occurs in brackish marshes or freshwater marshes at low elevations.	CNDDB	CNDDB							No suitable habitat in the Project area.
California clapper rail *Rallus longirostris obsoletus*	–/–/–/G5, T1, S1	California clapper rail found around northern and southern San Francisco Bay and San Pablo.	(Clapper Rails in General) Coastal subspecies prefer saltwater tidal marshes of pickleweed and chordgrass. Especially partial to tidal channels within the marsh for feeding. Yuma subspecies inhabits freshwater marshes vegetated with reed phragmites, bulrush, and cattail, and occasionally flooded desert brush and grasses.	USFWS	USFWS	USFWS						No suitable habitat in the Project area.

Table B-1 Continued

Species	Status[1] Federal/ State/ CNPS/ Other	Distribution	Habitat association	Potential occurrence by site (RM)[2]								Likelihood of occurrence in the Project area
				16.9L	19.4R, 19.0R	33.3R, 33.0R, 22.7R	48.2R, 47.9R, 44.7R, 43.7R	47.0L	62.5R	68.9L	78.0L	
Cooper's hawk *Accipiter cooperii*	SC/–/–/–	Throughout California except high altitudes in the Sierra Nevada. Winters in the Central Valley, southeastern desert regions, and plains east of the Cascade Range.	Nests in a wide variety of habitat types, from riparian woodlands and digger pine-oak woodlands through mixed conifer forests.			CNDDB	CNDDB	CNDDB	CNDDB	CNDDB		Suitable habitat occurs at each of the project sites, although the species was not observed during field surveys.
Double crested cormorant Rookeries *Phalacrocorax auritus*	–/–/– /G5, S3	Occur throughout the state and are widespread and breed from Cape Mendocino north to the Oregon border. Popular breeding centers are in and around the San Francisco Bay, Channel and Farralon Islands, Salton sea, although a rare breeder in the central valley.	Colonial nester on coastal cliffs, offshore islands, and lake margins. Usually nests on the ground with sloping surface or in tall trees along lake margins.			CNDDB	CNDDB	CNDDB	CNDDB			No suitable habitat in Project area.
Mountain plover *Charadrius montanu*	SC/CSC /–/–	Does not breed in California; in winter, found in the Central Valley south of Yuba County, along the coast in parts of San Luis Obispo, Santa Barbara, Ventura, and San Diego Counties; parts of Imperial, Riverside, Kern, and Los Angeles Counties .	Occupies open plains or rolling hills with short grasses or very sparse vegetation; nearby bodies of water are not needed; may use newly plowed or sprouting grainfields.						CNDDB	CNDDB	CNDDB	No suitable habitat in the Project area.
Purple martin *Progne subis*	–/CSC/– /–	An uncommon to rare, local summer resident in a variety of wooded, low-elevation habitats throughout California.	Inhabits woodlands, low elevation coniferous forest of douglas-fir, ponderosa pine, and Monterey pine.				CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	No suitable habitat in the Project area.

Table B-1 Continued

Species	Status[1] Federal/ State/ CNPS/ Other	Distribution	Habitat association	Potential occurrence by site (RM)[2]								Likelihood of occurrence in the Project area
				16.9L	19.4R, 19.0R	33.3R, 33.0R, 22.7R	48.2R, 47.9R, 44.7R, 43.7R	47.0L	62.5R	68.9L	78.0L	
Snowy egret rookery *Egretta thula*	–/–/– /G5, S4	Breeding areas are wide spread, scattered throughout the state, and are incompletely known. Documented in Humboldt, Del Norte, and Modoc Counties, lower Klamath River, and Sacramento and San Joaquin Valleys. Largest known colonies occur at the southern portion of Salton Sea.	Nest sites situated in low dead trees or bushes within or at the edge of freshwater lakes or in protected beds of dense tules close to foraging areas, marshes, tidal-flats, streams, wet meadows, and borders of lakes.						CNDDB	CNDDB	CNDDB	Suitable habitat exists in the Project area, although the species was not observed during field surveys.
Swainson's hawk *Buteo swainsoni*	SC/CT/– /–	Lower Sacramento and San Joaquin Valleys, the Klamath Basin, and Butte Valley. Highest nesting densities occur near Davis and Woodland, Yolo County.	Nests in oaks or cottonwoods in or near riparian habitats. Forages in grasslands, irrigated pastures, and grain fields.	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	Suitable habitat observed throughout the Project area, although the species was not observed during field surveys.
Tricolored blackbird *Agelaius tricolor*	SC/CSC /–/–	Permanent resident in the Central Valley from Butte County to Kern County. Breeds at scattered coastal locations from Marin County south to San Diego County; and at scattered locations in Lake, Sonoma, and Solano counties. Rare nester in Siskiyou, Modoc, and Lassen counties.	Nests in dense colonies in emergent marsh vegetation, such as tules and cattails, or upland sites with blackberries, nettles, thistles, and grainfields. Habitat must be large enough to support 50 pairs.	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	Suitable habitat observed at Sites RM 19.0R and 43.7R, although the species was not observed during field surveys.

Table B-1 Continued

Species	Status[1] Federal/ State/ CNPS/ Other	Distribution	Habitat association	Potential occurrence by site (RM)[2]								Likelihood of occurrence in the Project area
				16.9L	19.4R, 19.0R	33.3R, 33.0R, 22.7R	48.2R, 47.9R, 44.7R, 43.7R	47.0L	62.5R	68.9L	78.0L	
Western snowy plover *Charadrius alexandrinus nivosus*	T/CSC/–/–	Common on sandy marine and estuarine shores. Also occurs at isolated sites on the shores of alkali lakes in northeastern California, in the Central Valley, and southeastern deserts. Federal listing applies only to the Pacific coastal population.	Sandy beaches, salt pond levees, and shores of alkali lakes. Needs sandy, gravelly, or friable soils for nesting.				CNDDB, USFWS	CNDDB, USFWS	CNDDB, USFWS	CNDDB, USFWS	CNDDB, USFWS	No suitable habitat in the Project area.
Western burrowing owl *Athene cunicularia hypugea*	SC/CSC /–/–	Lowlands throughout California, including the Central Valley, northeastern plateau, southeastern deserts, and coastal areas. Rare along south coast.	Level, open, dry, heavily grazed or low- stature grassland or desert vegetation with available burrows.	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	No suitable habitat in the Project area.
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	–/CE/–/–	Nests along the Sacramento River (from Red Bluff to Colusa), South Fork Kern River (from Isabella Reservoir to Canebrake Ecological Reserve), Feather River (from Oroville to Verona, Butte, Yuba and Sutter counties); the Prado Flood Control Basin; Owens Valley; San Bernardino, Los Angeles, Imperial , San Bernardino, and Inyo counties; Santa Clara, Colorado, Mojavie, and Amargosa Rivers.	Wide, dense riparian forests with a thick understory of willows for nesting; sites with a dominant cottonwood overstory are preferred for foraging; may avoid valley-oak riparian habitats where scrub jays are abundant.			CNDDB	CNDDB	CNDDB	CNDDB, USFWS	USFWS	CNDDB, USFWS	Although suitable habitat is available in the Project area, it is outside the species' known range.

Table B-1 Continued

Species	Status[1] Federal/ State/ CNPS/ Other	Distribution	Habitat association	Potential occurrence by site (RM)[2]								Likelihood of occurrence in the Project area
				16.9L	19.4R, 19.0R	33.3R, 33.0R, 22.7R	48.2R, 47.9R, 44.7R, 43.7R	47.0L	62.5R	68.9L	78.0L	
White-faced ibis *Plegadis chihi*	SC/CSC/–/–	Both resident and winter populations on the Salton Sea and in isolated areas in Imperial, San Diego, Ventura, and Fresno counties; breeds at Honey Lake, Lassen County, at Mendota Wildlife Management Area, Fresno County, and near Woodland, Yolo County.	Prefers freshwater marshes with tules, cattails, and rushes, but may nest in trees and forage in flooded agricultural fields, especially flooded rice fields.						CNDDB	CNDDB	CNDDB	No suitable habitat in the Project area.
White-tailed kite *Elanus leucurus*	SC/FP/–/–	Lowland areas west of Sierra Nevada from the head of the Sacramento Valley south, including coastal valleys and foothills to western San Diego County at the Mexico border.	Low foothills or valley areas with valley or live oaks, riparian areas, and marshes near open grasslands for foraging.	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	Suitable habitat occurs at each of the project sites, although the species was not observed during field surveys.
Yellow-headed cowbird *Xanthocephalus xanthocephalus*	–/–/–/G5, S3, S4	Breeding areas in the northeastern portion of the state in the Klamath Basin, on the Modoc Plateau, and throughout the Basin and Ranges Region east of the Cascades-Sierra axis. Numerous colonies located from southern Tehema County to western Kern County. Irregular occurrences elsewhere in the state.	Nests in freshwater emergent wetlands with dense vegetation often near lakes or ponds. Nests only where large insects are abundant, nesting timed with maximum emergence of aquatic insects.			CNDDB	CNDDB	CNDDB	CNDDB			No suitable habitat in Project area.
Mammals												
American badger *Taxidea taxus*	SC/–/–/–	Uncommon, permanent resident found throughout he state, except in the northern North Coast area.	Most abundant in drier, open stages of most shrub, forest, and herbaceous habitats, with friable soils.	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB	CNDDB		No suitable habitat in Project area.

Table B-1 Continued

Species	Status[1] Federal/ State/ CNPS/ Other	Distribution	Habitat association	Potential occurrence by site (RM)[2]								Likelihood of occurrence in the Project area
				16.9L	19.4R, 19.0R	33.3R, 33.0R, 22.7R	48.2R, 47.9R, 44.7R, 43.7R	47.0L	62.5R	68.9L	78.0L	
Plants												
Suisun Marsh aster *Aster lentus*	– / – / 1B/–	Sacramento–San Joaquin Delta, Suisun Marsh, Suisun Bay, and Contra Costa, Napa, Sacramento, San Joaquin, and Solano counties.	Brackish and freshwater marshes and swamps; often associated with *Phragmites* spp. (reed), *Scirpus* spp. (tules), *Rubus* spp. (blackberry), and *Typha* spp. (cattails). Elevation: 0–3 m Blooming: May–November	CNDDB, CNPS	CNDDB	CNDDB, CNPS						No suitable habitat in the Project area.
Ferris's milk-vetch *Astragalus tener* var. *ferrisiae*	– / – / 1B/–	Butte, Colusa, Glenn, Solano, Sutter, and Yolo counties.	Vernally mesic meadows and seeps; subalkaline flats within valley and foothill grasslands; usually seen in dry, adobe soil. Elevation: 5–75 m Blooming: April–May	CNPS	CNDDB	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS			No suitable habitat in the Project area.
Alkali milk-vetch *Astragalus tener* var. *tener*	– / – / 1B/–	Alameda, Contra Costa, Merced, Monterey, Napa, San Benito, Santa Clara, San Francisco, San Joaquin, Solano, Sonoma, Stanislaus, and Yolo counties.	Playas, valley and foothill grasslands on adobe clay soils; alkaline vernal pools. Elevation:1–60 m Blooming: March–June			CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	No suitable habitat in the Project area.
Heartscale *Atriplex cordulata*	– / – / 1B/–	Alameda, Butte, Contra Costa, Fresno, Glenn, Kings, Kern, Madera, Merced, San Joaquin, Solano, Stanislaus, Tulare, and Yolo counties.	Chenopod scrub; meadows and seeps; valley and foothill grassland in sandy, saline or alkaline soils. Elevation: 1–375 m Blooming: April–October				CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNPS		No suitable habitat in the Project area.

Table B-1 Continued

Species	Status[1] Federal/ State/ CNPS/ Other	Distribution	Habitat association	Potential occurrence by site (RM)[2]								Likelihood of occurrence in the Project area
				16.9L	19.4R, 19.0R	33.3R, 33.0R, 22.7R	48.2R, 47.9R, 44.7R, 43.7R	47.0L	62.5R	68.9L	78.0L	
Brittlescale *Atriplex depressa*	– / – / 1B/–	Alameda, Contra Costa, Colusa, Fresno, Glenn, Merced, Solano, Tulare, and Yolo counties.	Chenopod scrub; meadows and seeps; valley and foothill grasslands; vernal pools; usually in alkali scalds or alkali clay; rarely associated with riparian marshes or valley playas. Elevation: 1–320 m Blooming: May– October				CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	No suitable habitat in the Project area.
San Joaquin spearscale *Atriplex joaquiniana*	– / – / 1B/–	Western edge of Central Valley in Alameda, Contra Costa, Colusa, Fresno, Glenn, Merced, Monterey, Napa, Sacramento, San Benito, Santa Clara, San Joaquin, San Luis Obispo, Solano, Tulare, and Yolo counties.	Chenopod scrub; meadows and seeps; playas; valley and foothill grassland in alkaline soils; often associated with *Distichilis* spp. (saltgrass) and *Frankenia* spp. (heath). Elevation: 1–835 m Blooming: April–October	CNDDB, CNPS	CNDDB	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS)	No suitable habitat in the Project area.
Bristly sedge *Carex comosa*	– / – / 2/–	Contra Costa, Lake, Mendocino, Sacramento, San Bernardino, Santa Cruz, San Francisco, Shasta, San Joaquin, and Sonoma counties; Idaho, Oregon, Washington and elsewhere.	Coastal prairie, marshes and swamps of lake margins, valley and foothill grasslands. Elevation: 0–625 m Blooming: May–September	CNDDB, CNPS	CNDDB	CNPS	CNPS	CNPS				No suitable habitat in the Project area.
Soft bird's-beak *Cordylanthus mollis* ssp. *mollis*	E/CR/1 B/–	Contra Costa, Marin, Napa, Sacramento, Solano, and Sonoma counties.	Coastal salt marshes and swamps; associated with *Distichilis* spp., *Salicornia* spp. (pickleweed), and *Frankenia* spp. Elevation: 0–3 m Blooming: July–November	CNDDB, CNPS	CNDDB							No suitable habitat in the Project area.

Table B-1 Continued

Species	Status[1] Federal/ State/ CNPS/ Other	Distribution	Habitat association	Potential occurrence by site (RM)[2]								Likelihood of occurrence in the Project area
				16.9L	19.4R, 19.0R	33.3R, 33.0R, 22.7R	48.2R, 47.9R, 44.7R, 43.7R	47.0L	62.5R	68.9L	78.0L	
Palmate-bracted bird's-beak *Cordylanthus palmatus*	E/CE/1B/–	Contra Costa, Marin, Napa, Sacramento, Solano, and Sonoma counties.	Chenopod scrub; valley and foothill grasslands; usually on alkaline soils; associated with *Distichilis* spp. and *Frankenia* spp. Elevation: 5–155 m Blooming: May–October						CNDDB, CNPS, USFWS	CNDDB, CNPS, USFWS	CNDDB, CNPS, USFWS	No suitable habitat in the Project area.
Dwarf downingia *Downingia pusilla*	– / – / 2/–	Fresno, Merced, Mariposa, Napa, Placer, Sacramento, Solano, Sonoma, Stanislaus, Tehama, Yuba counties and South America.	Mesic valley and foothill grasslands; vernal pools and lake margins. Elevation: 1–445 m Blooming: March–May	CNPS	CNDDB	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS)	No suitable habitat in the Project area.
Boggs Lake hedge-hyssop *Gratiola heterosepala*	– /CE/1B/ –	Fresno, Lake, Lassen, Madera, Merced, Modoc, Placer, Sacramento, Shasta, Siskiyou, San Joaquin, Solano, Tehama, Oregon	Vernal pools, clay soils; freshwater marshes and swamps; lake margins. Elevation: 5–2400 m Blooming: April–August					CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	No suitable habitat in the Project area.
Rose-mallow *Hibisucs lasiocarpus*	– / – / 2/–	Within the Delta watershed; Butte, Contra Costa, Colusa, Glenn, Sacramento, San Joaquin, Solano, Sutter, and Yolo counties.	Freshwater marshes and swamps; soaked river banks and low peat islands in sloughs. Elevation 0–120 m Blooming: June–September	CNDDB, CNPS	CNDDB	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	Potentially present; suitable habitat exists in the Project area.
Carquinez golden bush *Isocoma arguta*	– / – / 1B/–	Contra Costa and Solano counties.	Alkaline soils in valley and foothill grasslands; on low benches near drainages and on tops and sides of mounds in swale habitat. Elevation: 1–20 m Blooming: August–September	CNDDB	CNDDB	CNDDB						No suitable habitat in the Project area.

Table B-1 Continued

Species	Status[1] Federal/ State/ CNPS/ Other	Distribution	Habitat association	Potential occurrence by site (RM)[2]								Likelihood of occurrence in the Project area
				16.9L	19.4R, 19.0R	33.3R, 33.0R, 22.7R	48.2R, 47.9R, 44.7R, 43.7R	47.0L	62.5R	68.9L	78.0L	
Northern California black walnut *Juglans hindsii*	– / – / 1B/–	Native stands in Contra Costa, Lake, Napa, Sacramento, Solano, and Yolo counties.	Riparian forest; riparian woodland; deep alluvial soils associated with a creek or stream. Elevation: 0–440 m Blooming: April–May	CNDDB, CNPS	CNDDB	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS			Potentially present; suitable habitat exists in the Project area.
Delta tule pea *Lathyrus jepsonii* var. *jepsonii*	– / – / 1B/–	Central Valley (especially the San Francisco Bay region); Alameda, Contra Costa, Napa, Sacramento, Santa Clara, San Joaquin, and Solano counties.	Edges of freshwater and brackish marshes and swamps; edges of river banks; occasionally found along older riprapped banks. Elevation: 0–4 m Blooming: May–September	CNDDB, CNPS	CNDDB	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS				Potentially present; suitable habitat exists in the Project area.
Legenere *Legenere limosa*	– / – / 1B/–	Primarily located in the lower Sacramento Valley, also from north Coast Ranges, northern San Joaquin Valley and the Santa Cruz mountains; Lake, Napa, Placer, Sacramento, Santa Clara, Shasta, San Joaquin, San Mateo, Solano, Sonoma, Stanislaus, Tehama, and Yuba counties.	Vernal pools. Elevation: 1–800 m Blooming: April–June			CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS)	No suitable habitat in the Project area.
Heckard's pepper-grass *Lepidium latipes* var. *heckardii*	– / – / 1B/–	Glenn, Solano, and Yolo counties.	Alkanine flats of valley and foothill grasslands; sometimes vernal pool edges. Elevation: 10–200 m Blooming: March–May	CNDDB, CNPS	CNDDB	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	No suitable habitat in the Project area.

Table B-1 Continued

Species	Status[1] Federal/ State/ CNPS/ Other	Distribution	Habitat association	Potential occurrence by site (RM)[2]								Likelihood of occurrence in the Project area
				16.9L	19.4R, 19.0R	33.3R, 33.0R, 22.7R	48.2R, 47.9R, 44.7R, 43.7R	47.0L	62.5R	68.9L	78.0L	
Wooly-headed lessingia *Lessingia hololeuca*	– / – / 3/–	Alameda, Monterey, Marin, Napa, Santa Clara, San Mateo, Solano, Sonoma, and Yolo counties.	Broadleafed upland forest; coastal scrub; lower montane coniferous forest; valley and foothill grassland; in clay soils and serpentinite. Elevation: 15–305 m Blooming: June– October									No suitable habitat in the Project area.
Mason's lilaeopsis *Lilaeopsis masonii*	– / CR / 1B/–	Southern Sacramento Valley, Sacramento–San Joaquin Delta, northeast San Francisco Bay area; Alameda, Contra Costa, Napa, Sacramento, San Joaquin, and Solano counties.	Brackish or freshwater marshes and swamps; riparian scrub; in muddy or silty soil formed through river deposition or river bank erosion. Elevation: 0–10 m Blooming: April–November	CNDDB, CNPS	CNDDB	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS				Potentially present; suitable habitat exists in the Project area.
Delta mudwort *Limosella subulata*	– / – / 2/–	Primarily located in the Delta; Contra Costa, Sacramento, San Joaquin, and Solano counties, and Oregon.	Marshes and swamps; mud banks of the delta in marshy or scrubby riparian associations; often associated with *Lilaeopsis masonii*. Elevation: 0–3 m Blooming: May–August	CNDDB, CNPS	CNDDB	CNDDB, CNPS	CNPS	CNDDB				Potentially present; suitable habitat exists in the Project area.
Baker's navarretia *Navarretia leucocephala* ssp. *bakeri*	– / – / 1B/–	Colusa, Lake, Mendocino, Marin, Napa, Solano, Sonoma, Tehama, and Yolo counties.	Cismontane woodland; lower montane coniferous forest; meadows and seeps; valley and foothill grasslands; mesic vernal pools; adobe or alkaline soils. Elevation: 5–1740 m Blooming: April–July			CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS			No suitable habitat in the Project area.

Table B-1 Continued

Species	Status[1] Federal/ State/ CNPS/ Other	Distribution	Habitat association	Potential occurrence by site (RM)[2]								Likelihood of occurrence in the Project area
				16.9L	19.4R, 19.0R	33.3R, 33.0R, 22.7R	48.2R, 47.9R, 44.7R, 43.7R	47.0L	62.5R	68.9L	78.0L	
Colusa grass *Neostapfia colusana* And Critical Habitat	T/ CE/ 1B/–	Colusa, Merced, Solano, Stanislaus, and Yolo counties.	Usually in large or deep vernal pool bottoms in adobe soils. Elevation: 5–200 m Blooming: May–August			CNDDB, CNPS, USFWS	CNDDB, CNPS, USFWS	CNDDB, CNPS, USFWS	CNDDB, CNPS, USFWS	USFWS		No suitable habitat in the Project area.
Antioch Dunes evening Primrose *Oenothera deltoides* ssp. *howellii*	E/ CE/ 1B/–	Northeast San Francisco Bay region, known from three native occurrences; Contra Costa county.	Remnant river bluffs and sand dunes east of Antioch. Elevation: 0–30 m Blooming: March–September	CNDDB, CNPS, USFWS	CNDDB, USFWS							No suitable habitat in the Project area.
Eel-grass pondweed *Potamogeton zosteriformis*	– / – / 2/–	Contra Costa, Lake, Lassen, Modoc, and Shasta counties; Idaho, Oregon, Utah, Washington states.	Assorted freshwater marshes and swamps. Elevation: 0–1,860 m Blooming: June–July	CNDDB, CNPS	CNDDB							No suitable habitat in the Project area.
Sanford's arrowhead *Sagittaria sanfordii*	– / – / 1B/–	Scattered locations in Central Valley and Coast Ranges; Butte, Del Norte, Fresno, Kern, Merced, Mariposa, Orange, Sacramento, Shasta, San Joaquin, Tehama, and Ventura counties.	Assorted, shallow freshwater marshes and swamps; in standing or slow-moving freshwater ponds, marshes and ditches. Elevation: 0–610 m Blooming: May-October	CNDDB, CNPS	CNDDB	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS	CNDDB, CNPS		No suitable habitat in the Project area.
Marsh skullcap *Scuttelaria galericulata*	– / – / 2/–	El Dorado, Lassen, Modoc, Nevada, Placer, Plumas, Shasta, Siskiyou, and San Joaquin counties; Oregon state.	Lower montane coniferous forest; mesic meadows and seeps (mesic); marshes and swamps. Elevation: 0–2,100 m Blooming: June–September	CNDDB, CNPS	CNDDB							No suitable habitat in the Project area.
Blue skullcap *Scuttelaria lateriflora*	– / – / 2/–	Inyo and San Joaquin counties; New Mexico and Oregon states.	Mesic meadows and seeps; marshes and swamps. Elevation: 0–500 m Blooming: July–September	CNDDB, CNPS	CNDDB	CNDDB						No suitable habitat in the Project area.

Table B-1 Continued

Species	Status[1] Federal/ State/ CNPS/ Other	Distribution	Habitat association	Potential occurrence by site (RM)[2]								Likelihood of occurrence in the Project area
				16.9L	19.4R, 19.0R	33.3R, 33.0R, 22.7R	48.2R, 47.9R, 44.7R, 43.7R	47.0L	62.5R	68.9L	78.0L	
Solano grass *Tuctoria mucronata* And Critical Habitat	E / CE/ 1B/–	Solano and Yolo counties.	Clay bottoms of drying vernal pools and lakes in valley grassland. Elevation: 5–10 m Blooming: April–August			CNDDB, CNPS, USFWS	CNDDB, CNPS, USFWS	CNDDB, CNPS, USFWS	CNDDB, CNPS, USFWS			No suitable habitat in the Project area.

[1] Status:

Federal

E = Listed as endangered under the federal Endangered Species Act (ESA).
T = Listed as threatened under ESA.
C = Candidate for listing under ESA.
SC = Species of concern under ESA.
D = Delisted. Status to be monitored for 5 years.
PR = Protected under the Bald and Golden Eagle Protection Act.
– = No federal status.

State

CE = Listed as endangered under the California Endangered Species Act (CESA).
CT = Listed as threatened under CESA.
CR = Listed as rare under the California Endangered Species Act.
CSC = California species of special concern.
FP = Fully protected under California Fish and Game Code.
– = No state status.

CNPS

1A = Plants Presumed extinct in California
1B = Plants rare, threatened, or endangered in California and elsewhere
2 = Plants rare, threatened, or endangered in California, but more common elsewhere
3 = Plants for which more information is need to determine status

Other

USCB = United States Bird Conservation (Watch List)
Global and State Ranking determined by CNDDB were only noted for species that had neither a state nor federal listing
G1 = Extremely endangered throughout its worldwide range; <1,000 individuals, or <2,000 acres of occupied habitat.
G2 = Endangered throughout its worldwide range; 1,000 – 3,000 individuals, or 2,000 to 10,000 – 50,000 acres of occupied habitat.
G3 = Restricted throughout its worldwide range; 3,000 – 10,000 individuals or 10,000 – 50,000 acres of occupied habitat.
G5 = Demonstrably secure throughout its worldwide range; commonly found throughout its historic range.
S1 = Extremely endangered throughout its statewide range; <1,000 individuals, or <2,000 acres of occupied habitat.
S2 = Endangered throughout its statewide range; 1,000 – 3,000 individuals, or 2,000 to 10,000 – 50,000 acres of occupied habitat.

Table B-1 Continued

Other continued

S3	=	Restricted throughout its statewide range; 3,000 – 10,000 individuals or 10,000 – 50,000 acres of occupied habitat.
S4	=	Apparently secure throughout its statewide range; factors exist to cause concern of narrowing habitat or continuing threats.
TH	=	Subspecies may be extinct, but further field work is needed. All sites are historical.
SH	=	Species may be extinct, but further field work is needed. All sites are historical.
T1	=	Subspecies is extremely endangered throughout its worldwide range; <1,000 individuals, or <2,000 acres of occupied habitat.

[2] Potential occurrence by site is indicated where a species has been documented to occur, either historically or recently, based on one or more of the databases searched: the U.S. Fish and Wildlife Service USFWS project species list, California Natural Diversity Database CNDDB records, National Marine Fisheries Service (NMFS), and the California Native Plant Society (CNPS) database.

Table B-2. Wildlife species and habitat observed at the Project area during November 2006 survey.

Common name	Scientific name	RM 16.9L			RM 19.0R			RM 19.4R			RM 22.7R			RM 33.0R			RM 33.3R			RM 43.7		
		Observed	Habitat present	Habitat present within 0.25 mi	Observed	Habitat present	Habitat present within 0.25 mi	Observed	Habitat present	Habitat present within 0.25 mi	Observed	Habitat present	Habitat present within 0.25 mi	Observed	Habitat present	Habitat present within 0.25 mi	Observed	Habitat present	Habitat present within 0.25 mi	Observed	Habitat present	Habitat present within 0.25 mi
Invertebrates																						
Valley elderberry longhorn beetle*	*Desmocerus californicus dimorphus*																					
Herpetafauna																						
Red-eared Slider	*Chrysemys scripta*				X	X		X	X													
Western pond turtle*	*Clemmys marmorata*					X			X						X	X						
Avifauna																						
Acorn wood-pecker	*Melanerpes formicivorus*							X	X													
American goldfinch	*Carduelis tristis*				X	X					X	X										
American kestrel	*Falco sparverius*																					

Table B-3. Hypothesized timing of western pond turtle life stages along the Sacramento River. Source: Stillwater Sciences 2006[1].

Life stage	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Construction Period (year 1)												Phase 1
Construction Period (year 2)	Phase 1					Phase 2						
Nesting												
Egg incubation												
Hatchling emergence – southern pattern												
Hatchling overwintering												
Hatchling emergence – northern pattern												
Juvenile growth and adult activity												
Juvenile and adult overwintering												
Juvenile and adult return movements to the river (Reese and Walsh 1997)												

[1] Stillwater Sciences. 2006. Sacramento River ecological flows study: State of the system report. Public Review draft. Prepared by Stillwater Sciences, Berkeley for The Nature Conservancy, California.

	Period of low activity
	Period of moderate activity
	Period of peak activity

Appendix C-1

Maps of Existing Vegetation and Habitat Types

Figure C1-1. Existing vegetation and habitat types at Site RM 16.9L.

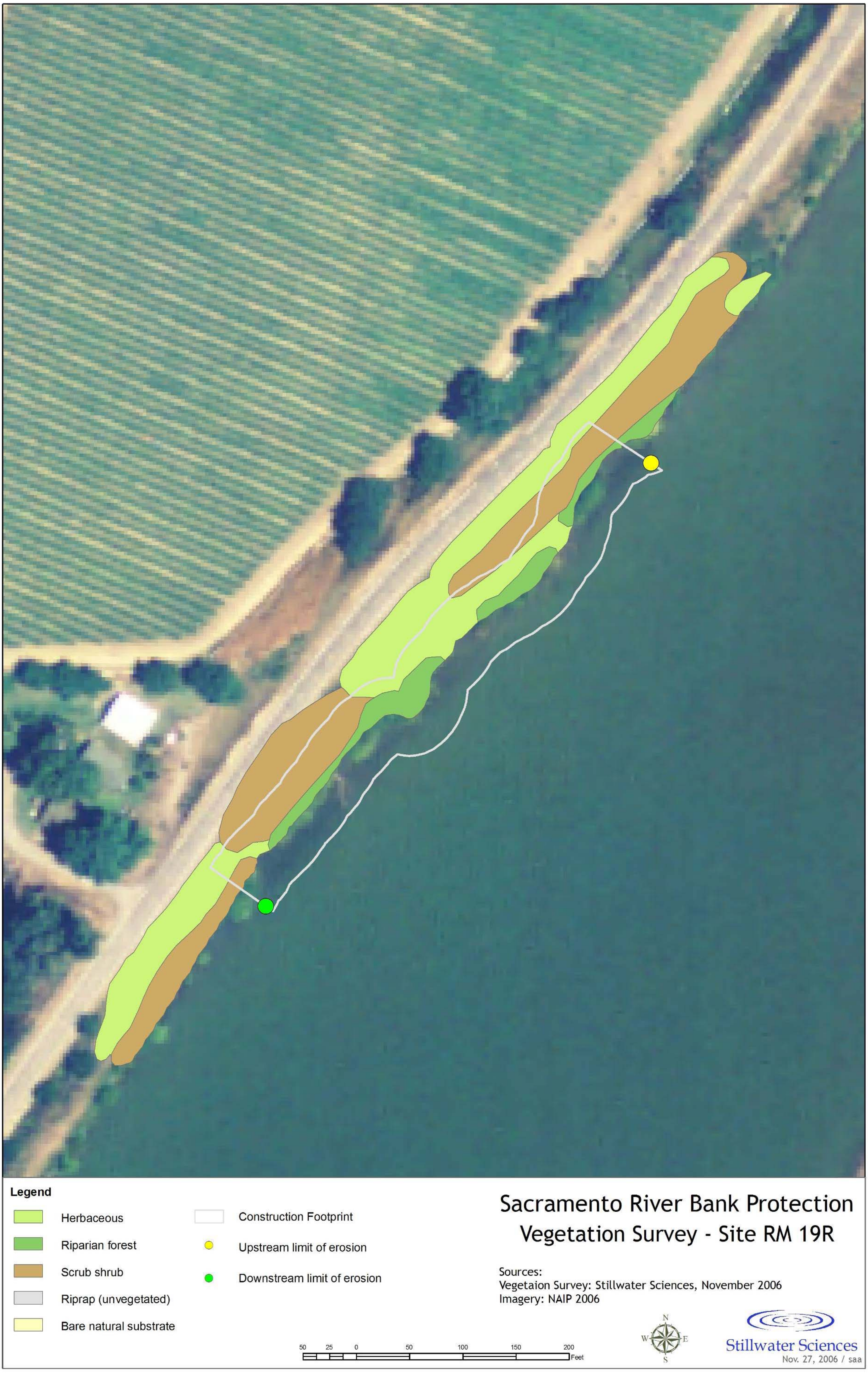

Figure C1-2. Existing vegetation and habitat types at Site RM 19.0R.

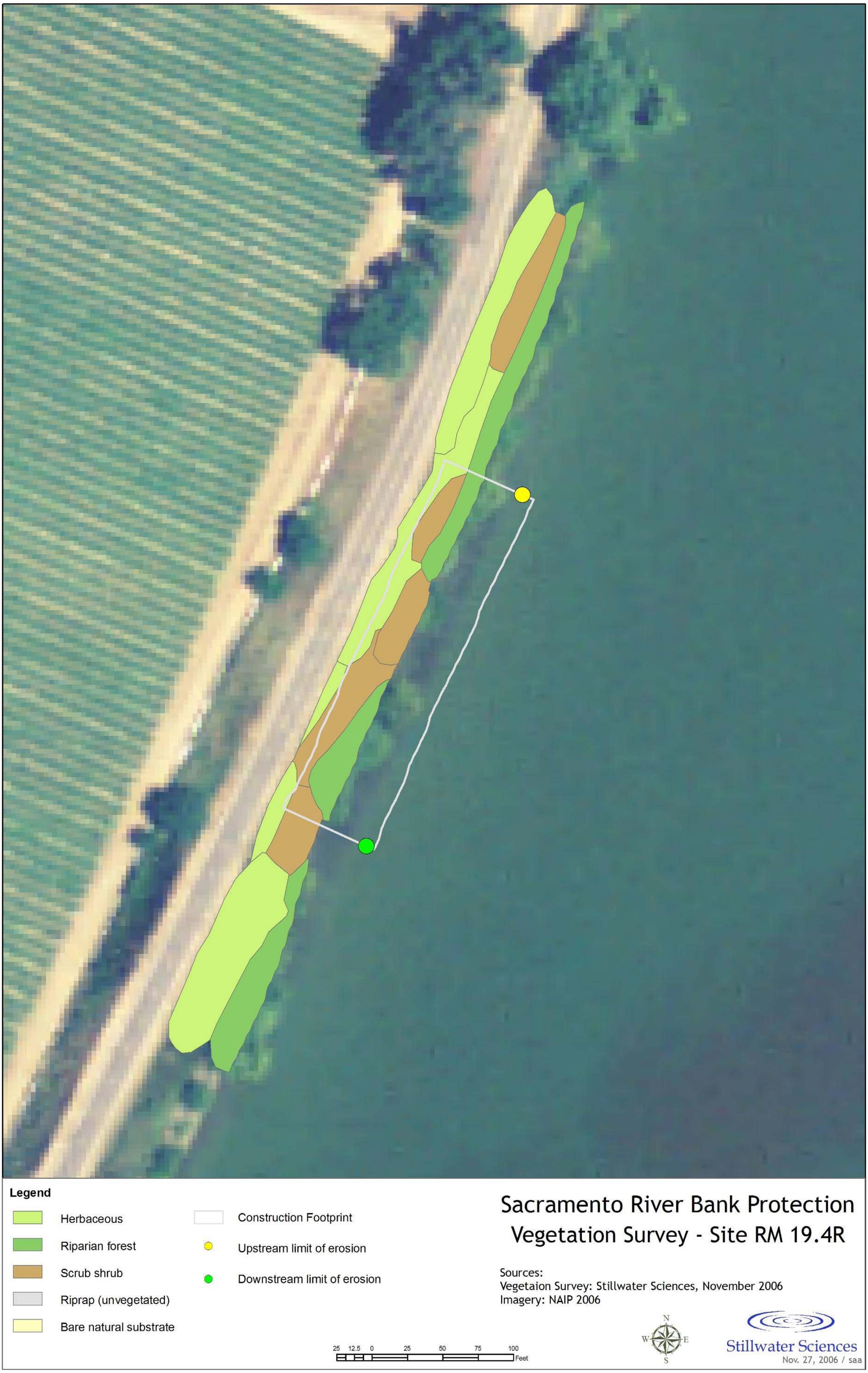

Figure C1-3. Existing vegetation and habitat types at Site RM 19.4R.

Figure C1-4. Existing vegetation and habitat types at Site RM 22.7R.

Figure C1-5. Existing vegetation and habitat types at Site RM 33.0R.

Figure C1-6. Existing vegetation and habitat types at Site RM 33.3R.

Figure C1-7. Existing vegetation and habitat types at Site RM 43.7R.

Figure C1-8. Existing vegetation and habitat types at Site RM 44.7R. Elderberry clumps correspond to data presented in Appendix C2.

Figure C1-9. Existing vegetation and habitat types at Site RM 47.0L. Elderberry clumps correspond to data presented in Appendix C2.

Figure C1-10. Existing vegetation and habitat types at Site RM 47.9R. Elderberry clumps correspond to data presented in Appendix C2.

Figure C1-11. Existing vegetation and habitat types at Site RM 48.2R. Elderberry clumps correspond to data presented in Appendix C2.

Figure C1-12. Existing vegetation and habitat types at Site RM 62.5R.

Figure C1-13. Existing vegetation and habitat types at Site RM 68.9L.

Figure C1-14. Existing vegetation and habitat types at Site RM 78.0L. Locations of non-native invasive tamarisk or salt cedar (*Tamarix ramosissima*) are also shown.

Appendix C-2

Summary of elderberry shrub survey results

Appendix C-2. Summary of elderberry shrub survey results
(surveys conducted between 7 and 14 November 2006).

Site (RM)	**Mapped clump ID**	**Shrub ID number**	**Number of stems by stem diameter at ground level**			**Exit holes present?**	**Shrub located in riparian habitat?**	**Shrub within Project footprint**	**Shrub within 100 ft of footprint**	**Shrub outside of 100 ft buffer**
			≥ 1– ≤ 3 in	**> 3– < 5 in**	**≥ 5 in**					
44.7R	1	1		1		no	yes	no	no	yes
44.7R	1	2			1	no	yes	no	no	yes
44.7R	1	3		2		no	yes	no	no	yes
44.7R	1	4	1			no	yes	no	no	yes
44.7R	1	5	3			no	yes	no	no	yes
44.7R	1	6	1			no	yes	no	no	yes
44.7R	1	7	1			no	yes	no	no	yes
44.7R	1	8			1	no	yes	no	no	yes
44.7R	1	9	2			no	yes	no	no	yes
44.7R	1	10		1		no	yes	no	no	yes
44.7R	1	11	1			no	yes	no	no	yes
44.7R	1	12	1	1		no	yes	no	no	yes
44.7R	1	13		1		no	yes	no	no	yes
44.7R	1	14	1	1		no	yes	no	no	yes
44.7R	1	15	2			no	yes	no	no	yes
44.7R	2	16	2	1		no	yes	no	yes	no
44.7R	2	17	2			no	yes	no	yes	no
44.7R	2	18	1			no	yes	no	yes	no
44.7R	2	19	2		1	no	yes	no	yes	no
44.7R	2	20	1			no	yes	no	yes	no
44.7R	2	21	1			no	yes	no	yes	no
44.7R	2	22	1			no	yes	no	yes	no
44.7R	2	23	2			no	yes	no	yes	no
44.7R	2	24	1			no	yes	no	yes	no
44.7R	2	25	2			no	yes	no	yes	no
44.7R	2	26			1	no	yes	no	yes	no
44.7R	2	27	1			no	yes	no	yes	no
44.7R	3	28	2			no	yes	no	yes	no
44.7R	3	29		1		no	yes	no	yes	no
44.7R	3	30	2			no	yes	no	yes	no
44.7R	3	31	1			no	yes	no	yes	no
44.7R	3	32	1			no	yes	no	yes	no
44.7R	3	33	1			no	yes	no	yes	no
44.7R	3	34	1			no	yes	no	yes	no
44.7R	3	35	1			no	yes	no	yes	no
44.7R	3	36	6	1	2	no	yes	no	yes	no
44.7R	3	37	1		1	no	yes	no	yes	no

Site (RM)	Mapped clump ID	Shrub ID number	Number of stems by stem diameter at ground level			Exit holes present?	Shrub located in riparian habitat?	Shrub within Project footprint	Shrub within 100 ft of footprint	Shrub outside of 100 ft buffer
			≥ 1– ≤ 3 in	> 3– < 5 in	≥ 5 in					
44.7R	3	38	2			no	yes	no	yes	no
44.7R	3	39	1			no	yes	no	yes	no
44.7R	3	40	1			no	yes	no	yes	no
44.7R	3	41	4			no	yes	no	yes	no
44.7R	3	42	2			no	yes	no	yes	no
44.7R	3	43	1			no	yes	no	yes	no
44.7R	3	44	1			no	yes	no	yes	no
44.7R	3	45	3			no	yes	no	yes	no
44.7R	3	46	3			no	yes	no	yes	no
44.7R	3	47	2			no	yes	no	yes	no
44.7R	3	48	1			no	yes	no	yes	no
44.7R	3	49	2			no	yes	no	yes	no
44.7R	3	50	1			no	yes	no	yes	no
44.7R	3	51	1			no	yes	no	yes	no
44.7R	3	52	2			no	yes	no	yes	no
44.7R	3	53	1			no	yes	no	yes	no
44.7R	3	54	1			no	yes	no	yes	no
44.7R	3	55	1			no	yes	no	yes	no
44.7R	3	56	1			no	yes	no	yes	no
44.7R	3	57	1			no	yes	no	yes	no
44.7R	3	58	2			no	yes	no	yes	no
44.7R	3	59	1			no	yes	no	yes	no
44.7R	3	60	1			no	yes	no	yes	no
44.7R	3	61	1			no	yes	no	yes	no
44.7R	3	62	1			no	yes	no	yes	no
44.7R	3	63	1			no	yes	no	yes	no
44.7R	3	64	4			no	yes	no	yes	no
44.7R	3	65	2			no	yes	no	yes	no
44.7R	3	66	3			no	yes	no	yes	no
44.7R	3	67			1	no	yes	no	yes	no
44.7R	3	68	1			no	yes	no	yes	no
44.7R	3	69	1			no	yes	no	yes	no
44.7R	3	70	2			no	yes	no	yes	no
44.7R	3	71	1			no	yes	no	yes	no
44.7R	3	72	1			no	yes	no	yes	no
44.7R	4	73	3			no	yes	no	yes	no
44.7R	4	74	2	1		no	yes	no	yes	no
44.7R	4	75		1		no	yes	no	yes	no
44.7R	4	76	1			no	yes	no	yes	no

Site (RM)	Mapped clump ID	Shrub ID number	Number of stems by stem diameter at ground level			Exit holes present?	Shrub located in riparian habitat?	Shrub within Project footprint	Shrub within 100 ft of footprint	Shrub outside of 100 ft buffer
			≥ 1– ≤ 3 in	> 3– < 5 in	≥ 5 in					
44.7R	4	77	1			no	yes	no	yes	no
44.7R	4	78	1			no	yes	no	yes	no
44.7R	4	79	1			no	yes	no	yes	no
44.7R	4	80	1			no	yes	no	yes	no
44.7R	4	81	1			no	yes	no	yes	no
44.7R	4	82	1			no	yes	no	yes	no
44.7R	4	83	1			no	yes	no	yes	no
44.7R	4	84	1			no	yes	no	yes	no
44.7R	4	85	1			no	yes	no	yes	no
44.7R	4	86	2			no	yes	no	yes	no
44.7R	4	87	2			no	yes	no	yes	no
47.0L	5	1	1			no	yes	no	yes	no
47.0L	5	2	1			no	yes	no	yes	no
47.0L	5	3	1			no	yes	no	yes	no
47.0L	5	4	3			no	yes	no	yes	no
47.0L	5	5	1			no	yes	no	yes	no
47.0L	5	6	1			no	yes	no	yes	no
47.0L	5	7	3			no	yes	no	yes	no
47.0L	5	8	2			no	yes	no	yes	no
47.9R	6	1	2			no	yes	yes	no	no
47.9R	6	2	2			no	yes	yes	no	no
47.9R	6	3	3			no	yes	yes	no	no
48.2R	7	1	1			no	yes	no	yes	no
48.2R	7	2	1			no	yes	no	yes	no
48.2R	8	3		1	1	yes - old; need to verify in Spring	yes	yes	yes	no
48.2R	8	4			1	no	yes	yes	yes	no
48.2R	8	5		1	1	no	yes	yes	yes	no
48.2R	8	6		1		no	yes	yes	yes	no

Appendix C-3

Baseline tree survey data for all Project sites

Appendix C-3. Baseline tree survey data for all Project sites (November 2006)

Scientific name	Northing	Easting	Number trunks	DBH (in)	Dripline diameter max X (ft)	Dripline diameter max Y (ft)	Mean dripline diameter (ft)	Est. Height (ft)	Notes, tree health, general condition (i.e., vigor)
Alnus rhombifolia	1821319.661	6672127.259	-	-	20	20	20	15-20	
Alnus rhombifolia	1821318.996	6672106.646	-	-	20	10	15	15-20	
Alnus rhombifolia	1821319.661	6672085.368	-	-	20	10	15	15-20	
Platanus racemosa	1821382.164	6671693.125	-	-	10	15	12.5	10	
Fraxinus latifolia	1821354.237	6671875.25	1	6	8	10	9	12	fair
Quercus agrifolia	1821311.302	6672027.04	2	12,18	36	30	33	25	
Quercus lobata	1821346.974	6671790.957	1	9	20	18	19	30	
Quercus agrifolia	1821353.368	6671780.812	1	9	25	15	20	30	
Quercus agrifolia	1821349.096	6671791.291	1	4	10	12	11	20	
Quercus agrifolia	1821347.69	6671807.848	1	12	35	17	26	35	
Quercus agrifolia	1821344.289	6671805.125	1	20	28	15	21.5	30	
Quercus lobata	1821353.865	6671825.896	1	6	20	10	15	15	
Alnus rhombifolia	1821353.907	6671830.4	3	8,8,6	20	25	22.5	25	
Alnus rhombifolia	1821351.033	6671835.576	7	6,6,4,5,5,10	40	30	35	35	
Quercus agrifolia	1821377.816	6671589.79	4	15,13,5.5,9	29	33	31	20	
Quercus agrifolia	1821371.696	6671671.035	1	30	42	41	41.5	30	
Quercus agrifolia	1821351.82	6671773.253	1	18	28	26	27	35	
Quercus agrifolia	1821353.532	6671765.659	1	8	15	15	15	20	
Quercus agrifolia	1821359.932	6671753.202	1	4	13	10	11.5	12	
Quercus agrifolia	1840437.595	6674284.259	2	13,8	15	25	20	22	
Juglans regia	1840424.169	6674326.215	1	9	10	20	15	28	
Alnus rhombifolia	1840430.043	6674341.319	4	5,10,10,5	12	28	20	20	
Fraxinus latifolia	1840548.358	6674423.552	2	10,6	12	18	15	25	
Fraxinus latifolia	1840556.749	6674432.783	2	5,6	15	10	12.5	20	
Alnus rhombifolia	1840576.049	6674429.426	1	8	12	12	12	28	
Fraxinus latifolia	1840575.209	6674438.656	3	12,10,8	20	15	17.5	25	
Fraxinus latifolia	1840609.613	6674448.726	4	5,12,10,4	22	20	21	30	
Alnus rhombifolia	1840615.487	6674461.312	3	6,6,4	10	12	11	20	
Alnus rhombifolia	1840630.591	6674462.152	1	10	10	20	15	25	
Alnus rhombifolia	1840621.361	6674473.06	5	8	10	22	16	28	
Alnus rhombifolia	1840638.982	6674483.129	1	12	8	15	11.5	15	
Alnus rhombifolia	1840657.443	6674499.912	1	10	22	10	16	10	
Alnus rhombifolia	1840711.146	6674547.741	1	6	10	5	7.5	18	
Alnus rhombifolia	1840821.489	6674655.148	6	4	10	12	11	18	
Alnus rhombifolia	1840832.398	6674669.413	1	8	5	5	5	10	
Salix goodingii	1840917.148	6674742.415	2	5,12	20	10	15	20	
Alnus rhombifolia	1840930.574	6674754.163	4	5,8,6,8	8	8	8	12	

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Acer negundo	1841031.268	6674830.522	1	6	8	5	6.5	23	
Fraxinus latifolia	1841120.214	6674902.686	1	5	10	10	10	20	
Juglans regia	1841136.157	6674919.468	1	7	12	22	17	23	
Acer negundo	1841150.422	6674916.951	1	5	10	10	10	22	
Alnus rhombifolia	1840682.624	6674498.124	2	10,18	15	20	17.5	25	
Alnus rhombifolia	1840707.313	6674524.853	4	10,8,8,8	12	15	13.5	22	
Alnus rhombifolia	1840709.741	6674526.522	1	8	12	12	12	22	
Alnus rhombifolia	1840711.446	6674530.612	2	8.5,12	15	10	12.5	25	
Alnus rhombifolia	1840732.985	6674545.149	2	20,10	18	15	16.5	25	
Alnus rhombifolia	1840739.585	6674557.646	2	12,6	10	15	12.5	15	
Fraxinus latifolia	1840742.442	6674557.664	1	10	15	10	12.5	23	
Alnus rhombifolia	1840742.625	6674573.055	7	10	15	20	17.5	15	
Alnus rhombifolia	1840755.969	6674583.475	3	10,8,8	25	20	22.5	18	
Alnus rhombifolia	1840854.399	6674682.585	4	4,20,12,10	20	15	17.5	20	
Alnus rhombifolia	1840856.269	6674685.594	7	7.5	10	12	11	18	
Alnus rhombifolia	1840945.476	6674745.022	2	20,18	18	10	14	15	
Acer negundo	1841008.739	6674803.622	3	6	10	20	15	28	
Alnus rhombifolia	1842229.042	6675489.878	8	15,5,5,5,10,10,8,8	25	30	27.5	25	
Alnus rhombifolia	1841970.834	6675380.246	7	10,10,12,7, 5,9,6	30	15	22.5	35	
Fraxinus latifolia	1841955.431	6675387.355	4	6,8,8,7.5	20	20	20	20	
Alnus rhombifolia	1842175.808	6675472.662	2	18,10	30	25	27.5	25	
Alnus rhombifolia	1842211.353	6675492.804	2	12,9	35	20	27.5	20	
Fraxinus latifolia	1842396.957	6675560.732	1	7	5	5	5	10	
Alnus rhombifolia	1842403.266	6675561.217	1	8	10	8	9	15	
Fraxinus latifolia			1	8	10	8	9	20	
Acer negundo	1842413.462	6675538.02	1	4	5	10	7.5	15	
Alnus rhombifolia	1842458.618	6675577.567	1	5	10	10	10	30	
Alnus rhombifolia	1842451.163	6675575.553	6	8,8,12,7,6,5	20	35	27.5	25	
Alnus rhombifolia	1842437.921	6675569.638	4	6,9,9,5	15	20	17.5	25	
Alnus rhombifolia	1842428.869	6675564.512	5	7,6,6,4,8	22	15	18.5	20	
Alnus rhombifolia	1842419.047	6675559.037	2	4,5	10	12	11	20	
Alnus rhombifolia	1842410.123	6675554.162	2	15,5	15	22	18.5	20	
Alnus rhombifolia	1842401.283	6675552.153	3	10,8,6	20	20	20	35	
Alnus rhombifolia	1842394.212	6675552.47	3	4,8,6	20	10	15	12	
Alnus rhombifolia	1842383.572	6675547.92	5	4,5,7,6,12	15	20	17.5	15	
Fraxinus latifolia	1842353.061	6675534.877	2	5,4	15	25	20	15	
Alnus rhombifolia	1842346.289	6675532.05	6	6,8,6,10,8, 11	20	35	27.5	15	

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Alnus rhombifolia	1842339.481	6675528.298	2	8,8	20	15	17.5	10	
Alnus rhombifolia	1842325.451	6675518.013	1	6	5	10	7.5	15	
Platanus racemosa	1842318.086	6675520.41	1	14	15	25	20	30	
Alnus rhombifolia	1842283.761	6675506.821	2	8,15	25	20	22.5	10	
Alnus rhombifolia	1842315.094	6675514.026	3	16,20,8	25	30	27.5	25	
Alnus rhombifolia	1842309.339	6675508.833	1	2	5	5	5	6	
Alnus rhombifolia	1842276.833	6675502.514	5	5,5,5,5,7.5	20	20	20	20	
Alnus rhombifolia	1842240.856	6675478.891	2	8,8	15	10	12.5	20	
Alnus rhombifolia	1842156.042	6675435.776	2	8,6	20	15	17.5	20	
Alnus rhombifolia	1842152.286	6675435.149	5	8,8,6,6,5	25	15	20	20	
Alnus rhombifolia	1842140.852	6675434.672	1	10	15	15	15	20	
Alnus rhombifolia	1842189.268	6675457.954	5	20,20,20,9,?	25	40	32.5	30	
Alnus rhombifolia	1842175.311	6675450.84	1	11	20	20	20	30	
Platanus racemosa	1842165.806	6675441.746	1	20	15	25	20	50	
Fraxinus latifolia	1842088.394	6675419.274	3	10,8,6	10	20	15	20	
Acer negundo	1842065.427	6675414.209	1	7.5	10	10	10	20	
Acer negundo	1841989.637	6675377.604	2	18,12	35	25	30	30	
Fraxinus latifolia	1842042.897	6675405.821	1	6	15	20	17.5	20	
Acer negundo	1841992.134	6675380.299	4	8,9,6,12	15	15	15	30	
Fraxinus latifolia	1842034.664	6675402.631	1	5	5	5	5	15	
Fraxinus latifolia	1842031.429	6675398.239	1	7	10	15	12.5	20	
Fraxinus latifolia	1842007.225	6675388.73	1	11	10	15	12.5	20	
Fraxinus latifolia	1842018.262	6675391.816	1	7	20	15	17.5	35	
Fraxinus latifolia	1842006.697	6675390.378	1	8.5	10	20	15	40	
Fraxinus latifolia	1842015.011	6675392.445	2	5.2,6	5	10	7.5	15	
Alnus rhombifolia	1857698.564	6678605.646	3	8,7,4	15	25	20	30	
Alnus rhombifolia	1857700.126	6678610.505	1	6	10	20	15	15	
Alnus rhombifolia	1857695.075	6678620.031	3	5,5,5	10	20	15	25	
Alnus rhombifolia	1857698.488	6678635.06	2	6,6	15	12	13.5	20	
Alnus rhombifolia	1857696.581	6678652.575	1	8	10	10	10	20	
Alnus rhombifolia	1857712.746	6678656.717	5	5,5,5,8,?	10	25	17.5	25	
Alnus rhombifolia	1857711.737	6678667.917	3	20,10,10	12	30	21	20	
Alnus rhombifolia	1857713.257	6678669.315	4	5,8,5,12	15	35	25	25	
Alnus rhombifolia	1857704.477	6678703.361	2	4,6	10	12	11	30	
Alnus rhombifolia	1857710.551	6678721.652	1	8	10	15	12.5	22	
Alnus rhombifolia	1857709.518	6678731.404	2	10,8	10	25	17.5	10	
Acer negundo	1857716.639	6678743.827	2	6,8,	10	10	10	15	

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Acer negundo	1857708.192	6678753.174	1	7	10	12	11	20	
Alnus rhombifolia	1857716.39	6678773.345	4	8,8,12.5,10	15	30	22.5	20	
Alnus rhombifolia	1857712.476	6678780.201	2	10,10	20	25	22.5	25	
Alnus rhombifolia	1857711.602	6678792.396	4	40,10,8,8	25	30	27.5	35	
Fraxinus latifolia	1857710.582	6678813.637	5	12,12,8,6,10	40	25	32.5	40	
Alnus rhombifolia	1857711.064	6678834.638	2	10,9	30	15	22.5	25	
Alnus rhombifolia	1857709.805	6678838.804	3	20,12,11	35	20	27.5	30	
Fraxinus latifolia	1857706.38	6678861.032	3	8,12,14	40	25	32.5	25	
Robinia pseudoacacia	1876413.502	6682522.767	3	11,11,6	43	36	39.5	35	good
Robinia pseudoacacia	1876501.868	6682506.03	1	12	32	19	25.5	45	good
Robinia pseudoacacia	1876504.917	6682505.197	2	9,5	25	10	17.5	45	good
Robinia pseudoacacia	1876467.664	6682512.451	1	25	40	31	35.5	40	good
Robinia pseudoacacia	1876469.896	6682510.833	1	6	15	20	17.5	30	good
Robinia pseudoacacia	1876486.56	6682509.977	1	13	35	25	30	40	good
Robinia pseudoacacia	1876491.164	6682508.091	1	10	0	0	0	0	dead
Quercus agrifolia	1876490.918	6682504.108	1	17	35	22	28.5	30	good
Quercus agrifolia	1876265.63	6682546.806	1	20	38	44	41	40	good
Fraxinus latifolia	1878024.433	6682527.545	1	8	20	19	19.5	25	
Robinia pseudoacacia	1878199.522	6682544.266	1	6.5	35	30	32.5	45	
Robinia pseudoacacia	1878252.112	6682445.915	1	13	50	40	45	45	
Robinia pseudoacacia	1878326.22	6682546.936	1	29	37	31	34	50	
Robinia pseudoacacia	1878358.044	6682546.235	1	10	50	40	45	45	
Ornamental	1878632.215	6682597.472	1	12	24	23	23.5	20	
Robinia pseudoacacia	1878337.403	6682560.659	2	4, 4	20	20	20	25	
Robinia pseudoacacia	1878385.879	6682566.523	2	6,4	25	30	27.5	30	
Robinia pseudoacacia	1878388.976	6682562.506	2	8,6	30	35	32.5	40	
Robinia pseudoacacia	1878221.334	6682540.535	1	4	15	12	13.5	40	
Robinia pseudoacacia	1878227.092	6682538.931	1	4	8	8	8	30	
Robinia pseudoacacia	1878223.628	6682544.813	1	4	10	12	11	35	
Robinia pseudoacacia	1878215.287	6682547.262	1	4.5	20	25	22.5	40	
Robinia pseudoacacia	1878211.158	6682548.102	1	4	20	15	17.5	35	
Robinia pseudoacacia	1878204.125	6682543.375	1	4	20	15	17.5	30	
Robinia pseudoacacia	1878199.522	6682544.266	2	4, 4	30	25	27.5	40	
Robinia pseudoacacia	1878194.744	6682548.415	1	5	20	20	20	30	
Quercus lobata	1878079.681	6682506.475	6	3,3,3,3,4,5	23	19	21	25	
Quercus agrifolia	1878000.205	6682498.776	1	4	20	20	20	15	
Robinia pseudoacacia			4	8,8,7,7	40	30	35	45	

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Salix goodingii	1920930.583	6696965.565	1	5	35	15	25	15	
Salix goodingii	1920945.591	6697067.541	1	5.5	10	12	11	25	
Quercus lobata	1920927.768	6697449.581	1	4.5	10	17	13.5	30	
Fraxinus latifolia	1920935.44	6697468.466	4	10,8,7,12	25	12	18.5	35	
Quercus lobata	1920954.915	6697610.102	1	8.2	22	15	18.5	40	
Acer negundo	1920940.162	6697613.052	2	9,8	35	22	28.5	30	
Quercus lobata	1920869.344	6698101.697	1	8	25	15	20	30	
Salix goodingii	1920878.786	6698153.63	1	5	5	12	8.5	15	
Quercus lobata	1920859.901	6698291.135	1	8	20	15	17.5	30	
Platanus racemosa	1920871.704	6698281.102	1	5	12	12	12	35	
Quercus lobata	1920828.033	6698370.805	1	4	15	10	12.5	30	
Quercus lobata	1920854	6698429.82	1	4	10	5	7.5	20	
Quercus lobata	1920961.611	6697148.059	1	13	24	27	25.5	50	
Populus fremontii ssp. fremontii	1920955.564	6697554.953	5	12.5,8,10,8,5	32	27	29.5	45	
Fraxinus latifolia	1920852.054	6698269.645	2	9,4	10	15	12.5	15	
Populus fremontii ssp. fremontii	1920854.175	6698263.271	1	72	50	30	40	50	
Quercus agrifolia	1920875.742	6698247.692	1	18	30	35	32.5	50	
Populus fremontii ssp. fremontii	1920863.533	6698159.298	1	30	52	35	43.5	60	
Fraxinus latifolia	1920860.517	6698147.102	3	10,11,15	30	27	28.5	30	
Quercus lobata	1920902.528	6698035.597	1	10	15	10	12.5	40	
Acer negundo	1920902.528	6698035.597	4	8,10,12,17	25	20	22.5	35	
Quercus lobata	1920902.528	6698035.597	2	18,8	42	25	33.5	40	
Acer negundo	1920895.476	6697992.227	2	9,9	20	12	16	20	
Salix goodingii	1920880.56	6697994.71	1	10	5	15	10	10	
Populus fremontii ssp. fremontii	1920896.697	6697972.578	2	24,72	50	37	43.5	70	
Fraxinus latifolia			1	7.9	12	10	11	12	
Populus fremontii ssp. fremontii			2	36,15	40	25	32.5	55	
Salix goodingii	1920887.769	6697922.298	1	14	15	20	17.5	30	
Populus fremontii ssp. fremontii	1920900.889	6697893.337	1	40	35	20	27.5	60	
Quercus lobata	1920929.033	6697883.427	1	14.8	35	17	26	30	
Quercus lobata	1920927.908	6697877.379	1	13	50	21	35.5	35	
Quercus lobata	1920936.912	6697854.562	3	28,5,7	47	35	41	45	
Acer negundo	1920923.679	6697848.474	3	11,10,9	15	27	21	30	
Populus fremontii ssp. fremontii	1920916.533	6697840.627	2	27,12	40	25	32.5	70	
Populus fremontii ssp. fremontii	1920912.052	6697727.695	2	36,40	52	40	46	60	
Quercus lobata	1920930.048	6697692.926	3	7.4,15,14	45	32	38.5	40	
Acer negundo	1920938.767	6697674.983	5	5,55,6,7,13	35	20	27.5	25	

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Quercus lobata	1920940.194	6697654.274	2	15,10.8	53	39	46	50	
Quercus lobata	1920953.158	6697629.248	2	9,6	40	35	37.5	40	
Populus fremontii ssp. fremontii	1920926.158	6697625.146	1	36	32	19	25.5	50	
Populus fremontii ssp. fremontii	1920931.951	6697621.162	3	50,24,36	48	37	42.5	65	
Acer negundo	1920945.716	6697590.67	2	11.5,12	30	42	36	35	
Acer negundo	1920942.785	6697583.114	1	15	25	37	31	35	
Platanus racemosa	1920931.169	6697570.824	2	8,16	30	19	24.5	38	
Salix goodingii	1920931.214	6697564.355	2	6,7	10	8	9	12	
Quercus lobata	1920949.123	6697493.256	1	12	37	30	33.5	35	
Acer negundo	1920944.533	6697575.525	2	6,8	15	26	20.5	40	
Populus fremontii ssp. fremontii	1920930.069	6697482.303	1	36	30	23	26.5	65	
Populus fremontii ssp. fremontii	1920949.446	6697395.587	1	20	45	30	37.5	60	
Populus fremontii ssp. fremontii	1920932.768	6697366.481	2	14,10	22	36	29	55	
Populus fremontii ssp. fremontii	1920936.022	6697363.936	2	5,5	15	25	20	35	
Quercus lobata	1920946.698	6697332.645	1	7	10	15	12.5	20	
Quercus lobata	1920946.698	6697332.645	3	10,21,10	50	35	42.5	50	
Populus fremontii ssp. fremontii	1920933.277	6697293.083	1	96	43	35	39	55	
Quercus lobata	1920943.96	6697295.595	1	16	38	25	31.5	45	
Quercus lobata	1920942.564	6697268.755	1	30	30	45	37.5	50	
Fraxinus latifolia	1920923.268	6697238.171	1	14	25	15	20	12	
Populus fremontii ssp. fremontii	1920935.223	6697080.609	1	23	42	27	34.5	65	
Populus fremontii ssp. fremontii	1920955.479	6697101.219	2	30,6	5	10	7.5	12	
Populus fremontii ssp. fremontii	1920955.479	6697101.219	1	40	5	10	7.5	10	
Quercus lobata	1920955.479	6697101.219	1	14.3	40	25	32.5	45	
Acer negundo	1920949.899	6697136.889	1	15	35	52	43.5	40	
Acer negundo	1920954.076	6697145.99	1	13	20	32	26	30	
Quercus lobata	1920956.141	6697006.689	1	8	36	30	33	35	
Quercus lobata	1920943.651	6696986.444	1	12	45	25	35	30	
Quercus lobata	1920957.301	6697054.727	1	8	20	35	27.5	25	
Quercus agrifolia	1921205.565	6701690.855	1	5.5	15	13	14	18	
Quercus agrifolia	1921206.302	6701717.731	1	8	14	14	14	26	
Quercus agrifolia	1921300.184	6701899.605	1	5	16	12	14	20	
Populus fremontii ssp. fremontii	1921454.078	6702281.393	3	33,33,16	55	35	45	65	
Quercus agrifolia	1921866.32	6702815.353	2	8,10	20	15	17.5	20	
Salix goodingii	1921515.561	6702397.734	1	10	10	15	12.5	15	
Robinia pseudoacacia			2	8,10	0	0	0	30	snag, dead
Robinia pseudoacacia			1	13	0	0	0	45	snag, dead

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Quercus agrifolia	1921438.615	6702205.551	2	10, 15	25	32	28.5	33	
Quercus agrifolia	1921852.766	6702798.102	1	4.5	12	10	11	12	
Robinia pseudoacacia	1921605.762	6702480.203	1	7	12	8	10	30	
Robinia pseudoacacia	1921592.876	6702482.412	1	7	5	10	7.5	10	
Quercus agrifolia	1921735.018	6702660.117	2	15,20	10	15	12.5	25	
Quercus agrifolia	1921733.222	6702697.532	2	20,24	37	45	41	45	
Populus fremontii ssp. fremontii	1921909.523	6702901.072	1	36	42	40	41	75	
Acer negundo	1921951.727	6702998.052	4	8,10,12,14	30	25	27.5	25	
Quercus agrifolia	1922026.797	6703038.161	1	6.7	10	12	11	25	
Acer negundo	1922010.634	6703039.059	5	5,5,5,8,8	42	25	33.5	35	
Acer negundo	1922018.29	6703024.121	5	8,6,6,8,12	45	32	38.5	28	
Quercus agrifolia	1922018.29	6703024.121	1	50	45	39	42	60	
Acer negundo	1921962.467	6702993.963	3	8,8.2,9	15	37	26	25	
Populus fremontii ssp. fremontii	1921942.035	6702984.451	1	5	5	8	6.5	12	
Quercus lobata	1921971.202	6702965.039	1	16	20	35	27.5	45	
Quercus lobata	1921970.011	6702975.872	1	17	30	52	41	50	
Quercus agrifolia	1921918.674	6702911.851	1	20	52	37	44.5	55	
Quercus agrifolia	1921913.521	6702918.95	2	10.5, ?	48	42	45	60	
Juglans regia	1921894.27	6702899.551	1	15.4	15	35	25	65	
Quercus agrifolia	1921900.634	6702902.84	1	5	10	8	9	25	
Quercus agrifolia	1921870.126	6702870.172	7	12,12,20,10,24,26,10	45	57	51	60	
Quercus agrifolia	1921833.632	6702843.037	1	35	38	20	29	55	
Quercus agrifolia	1921819.389	6702815.101	1	28	43	50	46.5	65	
Quercus lobata	1921822.454	6702819.304	1	14.4	25	40	32.5	50	
Populus fremontii ssp. fremontii	1921827.416	6702816.635	2	65,20	35	20	27.5	65	
Quercus agrifolia	1921815.863	6702800.499	2	8,18	45	23	34	45	
Populus fremontii ssp. fremontii	1921800.736	6702785.964	4	20,18,25,70	55	40	47.5	70	
Populus fremontii ssp. fremontii	1921754.256	6702754.557	1	29	10	23	16.5	55	
Populus fremontii ssp. fremontii	1921767.149	6702737.17	1	90	25	30	27.5	80	
Populus fremontii ssp. fremontii	1921762.501	6702734.96	1	40	40	53	46.5	60	
Quercus lobata	1921745.311	6702718.549	1	9	10	25	17.5	35	
Quercus lobata	1921761.328	6702728.475	1	23	15	25	20	50	
Robinia pseudoacacia	1921753.9	6702713.792	1	9	10	12	11	20	
Quercus agrifolia	1921753.9	6702713.792	3	7.4,20,40	45	36	40.5	55	
Quercus agrifolia	1921749.363	6702700.085	1	5	10	10	10	20	
Quercus lobata	1921740.96	6702698.056	1	8.5	15	20	17.5	15	
Quercus agrifolia	1921749.848	6702690.635	1	50	60	35	47.5	55	

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Quercus agrifolia	1921738.604	6702690.584	1	10.8	20	15	17.5	25	
Quercus agrifolia	1921738.604	6702690.584	1	14.8	50	42	46	50	
Quercus lobata	1921739.234	6702673.071	2	30,9	20	40	30	30	
Quercus agrifolia	1921721.598	6702679.001	1	11	15	20	17.5	30	
Quercus agrifolia	1921720.01	6702658.362	3	40,25,20	42	35	38.5	55	
Quercus agrifolia	1921709.84	6702648.741	1	5.5	10	12	11	15	
Populus fremontii ssp. fremontii	1921670.217	6702627.935	2	40,38	33	47	40	70	
Quercus agrifolia	1921704.441	6702614.229	2	9.6,7.2	25	35	30	30	
Quercus lobata	1921682.503	6702623.212	1	15	10	25	17.5	35	
Populus fremontii ssp. fremontii	1921520.083	6702397.83	3	16,15,18	25	30	27.5	60	
Robinia pseudoacacia	1921524.71	6702393.37	1	8	20	25	22.5	30	
Populus fremontii ssp. fremontii	1921524.71	6702393.37	1	21.7	36	32	34	65	
Populus fremontii ssp. fremontii	1921517.442	6702383.385	1	26.7	43	30	36.5	65	
Quercus lobata	1921517.442	6702383.385	1	21	64	54	59	55	
Populus fremontii ssp. fremontii	1921490.349	6702334.468	1	43	57	51	54	60	
Populus fremontii ssp. fremontii	1921451.825	6702273.761	1	36	38	29	33.5	75	
Quercus lobata	1921462.885	6702280.198	1	8	18	12	15	18	
Populus fremontii ssp. fremontii	1921427.855	6702218.143	1	40	60	35.8	47.9	75-80	
Populus fremontii ssp. fremontii	1921427.105	6702209.741	1	30	55	37.5	46.25	75-80	
Populus fremontii ssp. fremontii	1921421.882	6702202.121	1	40	53	27	40	75	
Populus fremontii ssp. fremontii	1921416.022	6702198.035	3	30,25,26	50	26	38	75	
Quercus lobata	1921499.918	6702339.451	2	7.7,14.7	40	54	47	25	
Populus fremontii ssp. fremontii	1921410.525	6702180.365	3	33,6.5,18	25	35	30	75	
Quercus lobata	1921419.05	6702181.68	1	22	38	38	38	25	
Populus fremontii ssp. fremontii	1921530.381	6702403.182	2	8,29	10	12	11	50	
Unknown - dead/down	1921539.117	6702415.103	1	18	0	0	0	50	down/dead
Platanus racemosa	1921378.131	6702137.941	1	11.5	25	17	21	25	
Salix goodingii	1921378.131	6702137.941	1	12	20	23	21.5	25	
Salix goodingii	1921378.131	6702137.941	1	8.5	20	29	24.5	25	
Quercus lobata	1921547.376	6702435.725	1	4.5	20	10	15	25	
Populus fremontii ssp. fremontii	1921547.376	6702435.725	5	24,32,28,30,33	55	42	48.5	65	
Populus fremontii ssp. fremontii	1921386.703	6702113.571	1	45	47	45	46	85	
Quercus lobata	1921387.395	6702123.284	1	10	25	28	26.5	35	
Populus fremontii ssp. fremontii	1921555.531	6702446.74	1	55	40	55	47.5	55	
Populus fremontii ssp. fremontii	1921355.539	6702069.773	2	33,10	50	40	45	80	
Robinia pseudoacacia	1921589.057	6702487.371	1	6	10	10	10	30	almost dead
Quercus agrifolia	1921637.949	6702587.547	1	6.8	15	23	19	35	

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Fraxinus latifolia	1921328.645	6702033.779	3	9,6.5,7	16	38	27	20	
Salix goodingii	1921327.076	6702036.388	2	12,11	35	30	32.5	25	
Populus fremontii ssp. fremontii	1921644.217	6702592.538	3	24,27,50	45	32	38.5	65	
Quercus lobata	1921334.833	6702026.121	1	32	46	40	43	70	
Populus fremontii ssp. fremontii	1921651.378	6702597.731	1	55	26	39	32.5	50	
Quercus lobata	1921616.02	6702493.008	1	18	60	20	40	40	
Robinia pseudoacacia	1921621.619	6702486.412	2	7,10	30	25	27.5	35	
Robinia pseudoacacia	1921615.129	6702488.509	1	8.4	0	0	0	45	dead
Robinia pseudoacacia	1921612.437	6702476.492	1	6.6	15	20	17.5	50	
Robinia pseudoacacia	1921613.055	6702493.86	2	8.5	20	15	17.5	50	
Robinia pseudoacacia	1921605.168	6702499.077	2	9,10	0	0	0	45	dead
Quercus lobata	1921584.358	6702441.679	2	7.5,11.7	15	25	20	40	
Robinia pseudoacacia	1921577.414	6702433.022	1	8.8	20	10	15	35	
Quercus agrifolia	1921337.321	6701992.58	1	23	45	54	49.5	40	
Quercus lobata	1921302.196	6701965.528	1	15	31	36	33.5	32	
Populus fremontii ssp. fremontii	1921287.354	6701923.576	1	37	45	47	46	75	
Populus fremontii ssp. fremontii	1921274.211	6701914.106	1	28	35	38	36.5	60	
Platanus racemosa	1921280.478	6701910.672	3	15,15,14	56	42	49	55	
Populus fremontii ssp. fremontii	1921284.947	6701906.038	1	16	35	27	31	56	
Platanus racemosa	1921284.947	6701906.038	2	11,14	35	29	32	50	
Quercus lobata	1921273.436	6701897.618	1	30	37	32.7	34.85	40	
Cephalanthus occidentalis	1921256.409	6701872.397	1	6	8	10	9	8	
Fraxinus latifolia	1921256.409	6701872.397	1	10	15	21	18	23	
Salix goodingii	1921238.651	6701845.984	1	16	30	20	25	14	
Robinia pseudoacacia	1921255.447	6701828.24	1	13	44	14.5	29.25	35	down
Robinia pseudoacacia	1921273.394	6701869.606	2	8,11	35	25	30	30	
Robinia pseudoacacia	1921273.394	6701869.606	1	15	35	27.4	31.2	30	
Robinia pseudoacacia	1921257.479	6701824.207	1	6	45	18	31.5	30	
Robinia pseudoacacia	1921247.08	6701828.295	2	6,9	30	25	27.5	18	
Robinia pseudoacacia	1921261.882	6701852.795	3	8,14,12	28	42	35	40	
Populus fremontii ssp. fremontii	1921238.31	6701832.739	2	27,9	49	35	42	66	
Robinia pseudoacacia	1921251.257	6701833.003	1	6	32	17	24.5	26	
Robinia pseudoacacia	1921254.892	6701807.82	1	7	20	20	20	26	
Robinia pseudoacacia	1921254.562	6701797.52	2	6,5	28	27	27.5	53	
Robinia pseudoacacia	1921252.316	6701791.044	1	11.5	25	24	24.5	28	
Robinia pseudoacacia	1921237.461	6701791.407	1	4	12	26	19	19	
Robinia pseudoacacia	1921250.255	6701782.293	1	7	28	22	25	40	

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Populus fremontii ssp. fremontii	1921227.166	6701791.239	1	36	62	38	50	77	
Robinia pseudoacacia	1921245.587	6701779.369	1	7.5	23	19	21	50	
Robinia pseudoacacia	1921242.475	6701775.709	1	11	53	25	39	55	
Acer negundo	1921223.718	6701767.004	3	5,12,8.5	26	25	25.5	19	
Robinia pseudoacacia	1921236.239	6701767.62	1	12.5	41	31	36	50	
Quercus lobata	1921217.492	6701732.839	1	19	38	39	38.5	39	
Robinia pseudoacacia	1921244.891	6701768.315	1	7	40	30	35	12	
Populus fremontii ssp. fremontii	1921208.96	6701725.339	1	36	60	35	47.5	60	
Robinia pseudoacacia	1921215.719	6701713.168	1	5.5	34	20	27	29	
Populus fremontii ssp. fremontii	1921198.02	6701707.992	1	-	0	0	0	-	downed snag
Populus fremontii ssp. fremontii	1921192.582	6701693.695	1	35	31	42	36.5	75	
Populus fremontii ssp. fremontii	1921187.501	6701658.762	1	37	40	66	53	81	
Populus fremontii ssp. fremontii	1921184.254	6701652.693	1	18	27	42	34.5	33	
Populus fremontii ssp. fremontii	1921175.781	6701650.396	4	38,30,36,36	80	56	68	120	
Quercus lobata	1921166.344	6701629.274	1	10	23	19	21	26	
Alnus rhombifolia	1921179.393	6701632.149	1	26	38	45	41.5	56	
Alnus rhombifolia	1921172.625	6701632.961	1	17	29	23	26	19	
Populus fremontii ssp. fremontii	1921146.99	6701605.683	1	33	25	28.5	26.75	76	
Populus fremontii ssp. fremontii	1921146.99	6701605.683	1	51	74	59.5	66.75	80	
Fraxinus latifolia	1921137.73	6701589.955	1	15	25	18	21.5	29	
Quercus lobata	1921162.214	6701587.201	1	3.5	15.6	12.8	14.2	15	
Populus fremontii ssp. fremontii	1921138.963	6701574.534	1	42	32	24	28	74	
Populus fremontii ssp. fremontii	1921150.992	6701561.271	1	9	30	12	21	39	mistletoe
Quercus agrifolia	1921777.425	6702727.86	2	15,30	20	30	25	70	
Robinia pseudoacacia	1921640.357	6702524.359	1	7	0	0	0	15	dead
Robinia pseudoacacia	1921637.95	6702530.671	1	9	20	15	17.5	45	
Robinia pseudoacacia	1921631.778	6702515.824	1	5	0	0	0	20	dead
Robinia pseudoacacia	1921629.689	6702509.85	2	6.5,8.5	0	0	0	40	dead
Robinia pseudoacacia	1921623.036	6702505.621	1	8.4	10	15	12.5	40	
Robinia pseudoacacia	1921623.036	6702505.621	1	7.8	12	20	16	30	lots of grape vines
Quercus lobata	1932589.067	6703806.942	1	12.5	20	40	30	38	mistletoe, cavity at breast height
Populus fremontii ssp. fremontii	1932625.046	6703738.41	2	19.8,20	10	20	15	50	
Populus fremontii ssp. fremontii	1932621.62	6703759.826	1	19.5	20	10	15	30	
Quercus lobata	1932893.176	6703759.826	1	18	40	30	35	40	
Quercus lobata	1932918.019	6703784.669	1	4.5	10	10	10	15	
Quercus lobata	1932779.881	6703797.47	1	12.3	30	20	25	40	
Quercus lobata	1932806.465	6703802.688	1	14.5	30	30	30	40	

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Quercus lobata	1932870.474	6703782.925	2	16,16.2	50	40	45	45	
Salix goodingii	1932862.705	6703738.61	1	36	40	20	30	40	
Salix goodingii	1932867.025	6703740.102	1	40	20	50	35	60	
Salix goodingii	1932871.723	6703739.888	1	18	15	30	22.5	30	
Salix goodingii	1932892.544	6703742.436	1	30	20	20	20	25	
Populus fremontii ssp. fremontii	1932912.586	6703746.141	1	7	10	10	10	20	
Populus fremontii ssp. fremontii	1932968.117	6703736.89	1	7.5	15	20	17.5	20	
Populus fremontii ssp. fremontii	1933008.522	6703730.119	1	40	20	15	17.5	60	
Populus fremontii ssp. fremontii	1933012.805	6703728.796	1	36	20	20	20	50	
Quercus lobata	1933034.676	6703733.713	1	12.2	20	40	30	20	leaning
Fraxinus latifolia	1933034.676	6703733.713	4	10.3,7,12,5.5	25	40	32.5	30	
Populus fremontii ssp. fremontii	1933034.676	6703733.713	3	32,40,50	40	60	50	50	
Quercus lobata	1933041.935	6703775.854	1	21.5	20	50	35	30	
Robinia pseudoacacia	1932763.165	6703790.413	2	11.1,10.2	20	15	17.5	35	mistletoe
Robinia pseudoacacia	1932742.341	6703797.189	1	11	20	30	25	45	
Robinia pseudoacacia	1932739.485	6703793.032	1	15.2	15	30	22.5	45	
Robinia pseudoacacia	1932727.592	6703793.077	1	11.2	10	20	15	50	
Robinia pseudoacacia	1932720.2	6703789.485	1	12	10	15	12.5	40	
Robinia pseudoacacia	1932717.151	6703793.013	1	11.8	40	10	25	50	
Robinia pseudoacacia	1932712.572	6703789.748	2	11.7,12.8	20	15	17.5	40	11.7 in trunk dying
Robinia pseudoacacia	1932708.911	6703794.189	2	11.4,7.4	8	10	9	35	
Robinia pseudoacacia	1932703.43	6703796.94	1	8	10	10	10	25	
Robinia pseudoacacia	1932702.477	6703794.267	1	6.8	8	10	9	20	
Robinia pseudoacacia	1932679.889	6703788.694	2	9.5,9.5	10	10	10	20	
Populus fremontii ssp. fremontii	1932671.987	6703758.1	2	24,19.7	20	20	20	35	
Populus fremontii ssp. fremontii	1932757.612	6703738.966	3	28,13.5,20	25	10	17.5	60	28 in trunk fallen into river
Populus fremontii ssp. fremontii	1932732.474	6703756.641	3	27,12,25	20	40	30	60	2 trunks recently fallen (25 and 12 in dbh)
Populus fremontii ssp. fremontii	1932806.652	6703738.049	1	18.1	10	8	9	55	dead top
Populus fremontii ssp. fremontii	1932815.96	6703731.875	1	18.2	25	10	17.5	50	
Populus fremontii ssp. fremontii	1932813.166	6703738.13	1	13.5	10	10	10	30	
Populus fremontii ssp. fremontii	1933114.367	6703722.625	4	55,32,25,30	60	40	50	50	
Salix goodingii	1933171.452	6703721.958	1	30	40	20	30	30	
Populus fremontii ssp. fremontii	1933203.174	6703717.11	1	60	20	50	35	60	
Populus fremontii ssp. fremontii	1933275.991	6703700.344	1	25	20	30	25	30	
Populus fremontii ssp. fremontii	1933287.609	6703702.487	1	23	20	30	25	50	
Populus fremontii ssp. fremontii	1933302.095	6703714.835	2	31.5,28.5	20	60	40	50	burnt at fork
Populus fremontii ssp. fremontii	1933323.708	6703684.558	1	23.2	0	0	0	20	snag, no crown

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Populus fremontii ssp. fremontii	1933328.165	6703688.642	1	27	50	50	50	30	
Populus fremontii ssp. fremontii	1933333.356	6703693.536	1	37.6	40	30	35	70	
Populus fremontii ssp. fremontii	1933346.524	6703674.635	1	36	30	30	30	50	
Salix goodingii	1933387.256	6703679.716	1	23	20	10	15	20	
Populus fremontii ssp. fremontii	1933398.765	6703677.249	1	30	15	20	17.5	50	
Populus fremontii ssp. fremontii	1933401.616	6703674.936	1	36	20	30	25	50	
Populus fremontii ssp. fremontii	1933404.818	6703674.431	1	36	30	30	30	50	
Populus fremontii ssp. fremontii	1933405.79	6703672.372	1	22	10	20	15	50	
Populus fremontii ssp. fremontii	1933409.903	6703670.422	1	32	20	40	30	50	
Populus fremontii ssp. fremontii	1933410.915	6703672.524	1	20	10	30	20	30	
Salix goodingii	1933491.263	6703646.922	1	24	20	35	27.5	25	
Quercus lobata	1933577.273	6703665.933	1	16.8	20	20	20	40	
Populus fremontii ssp. fremontii	1933643.948	6703574.634	3	24,24,24	20	40	30	40	
Populus fremontii ssp. fremontii	1933654.253	6703572.895	1	40	15	25	20	35	
Populus fremontii ssp. fremontii	1933729.455	6703543.255	1	18	25	12	18.5	20	
Populus fremontii ssp. fremontii	1933769.074	6703536.295	2	30,30	20	30	25	60	
Quercus lobata	1933782.886	6703546.82	1	11.2	25	20	22.5	20	
Populus fremontii ssp. fremontii	1933783.89	6703523.224	1	27	30	20	25	55	
Populus fremontii ssp. fremontii	1933829.335	6703503.552	2	24,14.6	30	20	25	50	
Quercus lobata	1933879.015	6703481.893	1	15.4	20	20	20	25	
Populus fremontii ssp. fremontii	1933894.446	6703431.861	2	30,30	40	20	30	40	
Populus fremontii ssp. fremontii	1933928.75	6703412.712	1	36	20	30	25	50	
Acer negundo	1933961.411	6703406.982	2	8.5,8.8	15	20	17.5	25	
Acer negundo	1933961.169	6703402.989	2	7.5,7.3	10	15	12.5	20	
Acer negundo	1933969.24	6703393.812	2	5.7,5.7	8	15	11.5	25	
Fraxinus latifolia	1933964.984	6703390.797	4	15,11,10.5,9.4	25	40	32.5	30	
Quercus agrifolia	1934040.445	6703365.277	1	32.4	30	40	35	25	
Quercus agrifolia	1934142.066	6703268.805	3	20,9.8	20	35	27.5	30	
Platanus racemosa	1934068.671	6703253.104	2	8,6	10	10	10	20	
Platanus racemosa	1934065.495	6703254.023	2	5,4	8	15	11.5	12	
Platanus racemosa	1934081.021	6703239.537	1	9.3	8	15	11.5	15	
Platanus racemosa	1934574.473	6699872.153	1	6	15	10	12.5	12	
Robinia pseudoacacia	1934563.174	6699467.965	1	7	10	10	10	20	
Populus fremontii ssp. fremontii	1934572.701	6699401.279	1	8	8	10	9	20	
Fraxinus latifolia	1934577.031	6699389.155	1	8	20	15	17.5	15	
Populus fremontii ssp. fremontii	1934581.361	6699377.463	1	8	15	10	12.5	20	
Salix goodingii	1934561.442	6699351.481	1	20	20	35	27.5	25	fallen

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Ficus carica	1934563.174	6699133.02	1	6	10	20	15	12	
Robinia pseudoacacia	1934570.102	6699079.757	1	7	5	5	5	30	
Ailanthus altissima	1934481.476	6700092.615	2	7.7	15	15	15	25	
Ailanthus altissima	1934494.332	6700075.646	2	7,5	10	20	15	32	
Ailanthus altissima	1934496.793	6700079.612	1	8.5	10	10	10	25	
Ailanthus altissima	1934498.742	6700078.513	1	6	0	0	0	30	dead
Ailanthus altissima	1934496.852	6700074.775	1	8	10	10	10	30	
Ailanthus altissima	1934492.374	6700070.472	1	7.6	10	15	12.5	35	
Ailanthus altissima	1934489.879	6700062.492	1	7.5	10	10	10	30	
Ailanthus altissima	1934486.571	6700051.563	1	7.5	10	12	11	28	
Ailanthus altissima	1934487.511	6700050.001	1	6.9	10	10	10	34	
Ailanthus altissima	1934495.238	6700047.301	2	8,7.9	10	30	20	38	
Ailanthus altissima	1934493.217	6700044.081	1	8.9	10	10	10	32	
Ailanthus altissima	1934492.069	6700043.014	1	9.8	15	10	12.5	35	
Ailanthus altissima	1934490.621	6700041.677	1	8.1	10	8	9	25	
Ailanthus altissima	1934491.556	6700035.18	1	6.8	10	10	10	28	
Ailanthus altissima	1934492.478	6700020.855	1	4	15	10	12.5	30	
Ailanthus altissima	1934495.592	6700018.955	1	6	10	10	10	36	
Ailanthus altissima	1934494.809	6700015.959	1	7.5	15	10	12.5	35	
Ailanthus altissima	1934495.796	6700005.588	1	7.6	10	10	10	30	
Ailanthus altissima	1934493.427	6700003.189	1	7.5	15	10	12.5	32	
Ailanthus altissima	1934495.619	6700002.239	1	8.1	10	10	10	35	
Ailanthus altissima	1934494.351	6699999.166	1	8	15	15	15	34	
Ailanthus altissima	1934496.255	6699991.665	1	7.7	20	10	15	31	
Ailanthus altissima	1934497.272	6699989.492	1	8.2	12	15	13.5	34	
Quercus lobata	1934516.835	6699928.676	2	24,15	30	25	27.5	40	
Quercus lobata	1934554.017	6699274.726	3	24,18,10	35	18	26.5	40	
Quercus lobata	1934555.384	6699275.913	2	30,25	40	40	40	35	
Quercus lobata	1934551.247	6699471.824	1	30	30	30	30	40	
Robinia pseudoacacia	1934550.615	6699363.381	1	9	0	0	0	35	dead
Robinia pseudoacacia	1934551.14	6699355.499	1	7.5	0	0	0	35	dead
Robinia pseudoacacia	1934551.963	6699340.663	1	8.1	0	0	0	30	dead
Robinia pseudoacacia	1934553.52	6699334.407	1	7	0	0	0	30	dead
Robinia pseudoacacia	1934560.229	6699339.42	3	6,6,6	0	0	0	32	dead
Robinia pseudoacacia	1934563.85	6699316.542	1	5	8	8	8	32	
Robinia pseudoacacia	1934568.716	6699314.035	1	4	8	5	6.5	35	
Robinia pseudoacacia	1934567.432	6699309.201	1	8.8	8	8	8	30	

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Robinia pseudoacacia	1934574.354	6699305.37	1	6.9	8	5	6.5	28	
Robinia pseudoacacia	1934574.371	6699293.994	1	8.6	10	20	15	25	
Robinia pseudoacacia	1934572.371	6699288.104	1	8	10	30	20	12	
Robinia pseudoacacia	1934575.694	6699285.632	1	8	10	10	10	30	
Robinia pseudoacacia	1934553.778	6699304.757	1	9.2	8	8	8	32	
Robinia pseudoacacia	1934559.929	6699306.748	1	7.2	8	5	6.5	30	
Robinia pseudoacacia	1934567.954	6699261.844	3	6,6,6	0	0	0	30	dead
Robinia pseudoacacia	1934565.913	6699254.843	2	8,6	0	0	0	28	dead
Robinia pseudoacacia	1934569.756	6699252.316	1	7.5	0	0	0	30	dead
Robinia pseudoacacia	1934564.832	6699243.388	1	9	8	8	8	32	
Robinia pseudoacacia	1934565.704	6699223.551	1	9	20	15	17.5	35	
Robinia pseudoacacia	1934572.329	6699226.315	4	6	20	10	15	30	
Robinia pseudoacacia	1934570.388	6699212.012	1	7	10	10	10	28	
Robinia pseudoacacia	1934568.644	6699199.902	1	8	10	12	11	32	
Robinia pseudoacacia	1934566.895	6699198.326	1	5	15	10	12.5	30	
Robinia pseudoacacia	1934569.995	6699192.476	2	5	15	15	15	30	
Robinia pseudoacacia	1934572.736	6699193.967	1	6	10	10	10	30	
Populus fremontii ssp. fremontii	1934587.606	6699081.852	2	30	20	20	20	20	dead
Juglans regia	1934585.374	6699087.343	2	10,12	40	10	25	25	10 in trunk dead
Populus fremontii ssp. fremontii	1934583.844	6699097.845	1	36	30	35	32.5	55	
Populus fremontii ssp. fremontii	1934596.697	6699089.908	1	33	10	15	12.5	50	
Salix goodingii	1934599.261	6699084.01	1	20,8	20	25	22.5	28	
Populus fremontii ssp. fremontii	1934595.522	6699117.427	2	15,22	10	10	10	45	22 in trunk dead
Quercus lobata	1934580.43	6699115.294	1	18	30	20	25	45	
Quercus lobata	1934580.462	6699125.247	2	18,12	30	35	32.5	40	
Quercus lobata	1934577.98	6699146.854	1	20	30	20	25	25	
Populus fremontii ssp. fremontii	1934585.614	6699148.441	2	40,40	25	15	20	35	tops are dead
Populus fremontii ssp. fremontii	1934601.396	6699146.127	1	18	15	10	12.5	45	
Quercus lobata	1934591.794	6699179.394	2	22,10	30	20	25	35	
Populus fremontii ssp. fremontii	1934596.848	6699180.87	1	28	15	15	15	50	
Robinia pseudoacacia	1934584.024	6699191.442	2	6,8	10	25	17.5	35	
Populus fremontii ssp. fremontii	1934581.432	6699406.795	2	24,28	30	20	25	45	
Quercus lobata	1934572.251	6699422.938	1	40	20	25	22.5	55	
Populus fremontii ssp. fremontii	1934560.142	6699425.613	1	24	10	10	10	50	
Populus fremontii ssp. fremontii	1934561.59	6699400.465	1	26	30	25	27.5	55	
Robinia pseudoacacia	1934559.42	6699410.549	1	6	10	10	10	35	dead/dying
Populus fremontii ssp. fremontii	1934553.41	6699455.997	1	12	10	20	15	35	

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Robinia pseudoacacia	1934563.425	6699455.82	1	5	8	8	8	25	
Populus fremontii ssp. fremontii	1934560.62	6699433.794	1	5	8	8	8	30	
Quercus lobata	1934573.575	6699442.578	1	10	5	8	6.5	20	
Populus fremontii ssp. fremontii	1934571.377	6699477.668	2	32,40	20	25	22.5	40	
Populus fremontii ssp. fremontii	1934569.539	6699482.861	1	12	10	8	9	20	
Quercus lobata	1934565.651	6699492.428	1	40	30	20	25	45	
Populus fremontii ssp. fremontii	1934575.996	6699496.842	1	36	10	10	10	48	
Populus fremontii ssp. fremontii	1934581.017	6699502.493	1	40	8	8	8	50	
Populus fremontii ssp. fremontii	1934581.017	6699502.493	3	40,35,35	20	30	25	50	
Populus fremontii ssp. fremontii	1934580.649	6699510.984	1	60	10	20	15	50	hole in base
Quercus lobata	1934570.942	6699510.241	1	7	5	8	6.5	20	
Populus fremontii ssp. fremontii	1934569.162	6699524.049	2	20.8	10	10	10	55	
Quercus lobata	1934556.17	6699527.63	1	30	20	25	22.5	40	
Populus fremontii ssp. fremontii	1934567.651	6699535.76	1	52	20	15	17.5	60	
Populus fremontii ssp. fremontii	1934564.764	6699548.423	1	33	20	20	20	45	
Populus fremontii ssp. fremontii	1934576.362	6699556.396	1	18	15	8	11.5	30	
Populus fremontii ssp. fremontii	1934575.786	6699560.327	2	40,33	10	12	11	35	
Populus fremontii ssp. fremontii	1934579.817	6699568.72	1	36	12	10	11	40	
Populus fremontii ssp. fremontii	1934565.118	6699586.826	3	20,20,8	25	15	20	48	
Quercus lobata	1934559.718	6699586.322	1	6.1	10	12	11	15	
Quercus lobata	1934565.498	6699613.301	2	8.8,7.9	20	15	17.5	20	
Populus fremontii ssp. fremontii	1934556.078	6699622.199	1	18	20	10	15	25	
Populus fremontii ssp. fremontii	1934560.722	6699626.531	2	42,33	30	25	27.5	50	
Populus fremontii ssp. fremontii	1934574.022	6699607.981	2	36,24	15	15	15	50	
Populus fremontii ssp. fremontii	1934575.516	6699629.015	1	28	10	8	9	30	
Populus fremontii ssp. fremontii	1934561.446	6699642.061	1	36	8	8	8	35	
Quercus lobata	1934553.324	6699645.174	1	14	20	12	16	25	
Populus fremontii ssp. fremontii	1934558.911	6699651.16	1	36	20	10	15	50	
Populus fremontii ssp. fremontii	1934556.611	6699662.111	1	33	20	10	15	35	
Fraxinus latifolia	1934564.661	6699664.293	6	8	20	12	16	20	
Populus fremontii ssp. fremontii	1934548.651	6699669.835	1	30	40	10	25	40	
Populus fremontii ssp. fremontii	1934558.034	6699682.01	1	30	20	10	15	52	
Populus fremontii ssp. fremontii	1934567.796	6699686.343	1	10	15	8	11.5	15	
Populus fremontii ssp. fremontii	1934568.838	6699694.98	3	20,25,15	15	15	15	45	
Quercus lobata	1934551.543	6699748.111	1	20	25	15	20	50	
Quercus lobata	1934545.786	6699778.161	2	10,8	20	15	17.5	50	
Populus fremontii ssp. fremontii	1934557.827	6699776.973	1	40	25	12	18.5	55	

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Quercus lobata	1934551.909	6699794.124	1	38	20	35	27.5	55	
Populus fremontii ssp. fremontii	1934562.176	6699781.464	1	24	20	15	17.5	40	
Populus fremontii ssp. fremontii	1934557.603	6699798.013	1	12	10	10	10	25	
Salix goodingii	1934552.349	6699802.922	1	33	30	15	22.5	35	
Quercus lobata	1934540.669	6699809.889	2	22,18	30	20	25	40	
Fraxinus latifolia	1934557.121	6699812.304	3	8,8,6	20	30	25	25	
Salix goodingii	1934558.825	6699826.13	1	6	20	10	15	10	
Populus fremontii ssp. fremontii	1934550.897	6699831.728	2	25,18	0	0	0	55	dead
Populus fremontii ssp. fremontii	1934551.662	6699838.187	3	30,22,8	15	20	17.5	60	
Populus fremontii ssp. fremontii	1934553.973	6699848.273	1	24	30	20	25	55	
Quercus lobata	1934536.471	6699822.216	3	12,6,8	25	12	18.5	25	
Quercus lobata	1934529.673	6699846.274	1	49.2	40	50	45	60	
Salix goodingii	1934543.942	6699876.356	1	18	40	20	30	35	
Salix goodingii	1934547.162	6699888.773	1	8	20	15	17.5	25	
Fraxinus latifolia	1934540.742	6699908.505	1	8	12	10	11	20	
Quercus lobata	1934524.798	6699921.544	2	14,16	10	15	12.5	25	
Quercus lobata	1934519.721	6699920.842	1	18	40	20	30	15	leaning/fallen
Populus fremontii ssp. fremontii	1934545.578	6699939.945	4	30,30,30,8.9	40	20	30	50	
Quercus lobata	1934532.387	6699941.856	1	17.5	35	20	27.5	35	
Fraxinus latifolia	1934550.442	6699938.901	2	8.6	20	10	15	8	
Salix goodingii	1934537.818	6699956.482	1	11.5	10	10	10	12	
Quercus lobata	1934526.694	6699972.151	1	24	40	35	37.5	40	
Quercus lobata	1934528.144	6700024.952	1	33	30	10	20	40	Fallen into river, half dead
Quercus lobata	1934520.386	6700052.711	4	11.7,33,16,5.9	35	40	37.5	40	
Quercus lobata	1934513.273	6700036.087	2	15,11.6	25	30	27.5	35	
Quercus lobata	1934500.161	6700058.361	1	15.1	10	30	20	38	
Salix goodingii			2	30,8	20	40	30	12	
Robinia pseudoacacia			1	5	0	0	0	20	dead
Robinia pseudoacacia			1	6	0	0	0	22	dead
Robinia pseudoacacia			1	5.5	0	0	0	24	dead
Robinia pseudoacacia	1934566.638	6699044.379	1	5	2	2	2	20	
Robinia pseudoacacia	1934569.236	6699037.018	1	5.5	0	0	0	20	dead
Robinia pseudoacacia			1	6.4	0	0	0	20	dead
Robinia pseudoacacia			3	4,5.4,5	0	0	0	22	dead
Robinia pseudoacacia	1934568.803	6699000.21	2	5.5,4.4	15	10	12.5	25	
Robinia pseudoacacia	1934574	6698991.983	1	5.5	5	5	5	27	
Robinia pseudoacacia	1934566.205	6698990.251	1	4	10	5	7.5	20	

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Robinia pseudoacacia	1934566.205	6698979.425	2	5,5	15	10	12.5	20	
Robinia pseudoacacia	1934573.134	6698974.662	1	5.5	5	5	5	20	
Robinia pseudoacacia	1934568.37	6698972.93	1	4.5	8	5	6.5	22	
Robinia pseudoacacia			1	5	0	0	0	20	dead
Robinia pseudoacacia	1934575.732	6698962.537	3	7.5,5.2,6	15	12	13.5	22	
Robinia pseudoacacia			1	4	0	0	0	22	dead
Robinia pseudoacacia	1934582.227	6698954.743	1	5.5	12	10	11	18	
Robinia pseudoacacia	1934583.093	6698963.403	1	7.3	15	15	15	20	
Populus fremontii ssp. fremontii	1934624.664	6698977.693	2	40,38	40	20	30	40	
Robinia pseudoacacia	1934565.772	6698956.475	1	4	2	2	2	12	
Acer negundo	1934607.776	6698950.845	2	18,12	10	20	15	20	
Acer negundo	1934609.075	6698945.649	1	8	10	20	15	25	
Populus fremontii ssp. fremontii	1934616.869	6698917.502	2	50,20	25	20	22.5	55	
Robinia pseudoacacia	1934573.134	6698938.288	2	6,8	10	15	12.5	20	
Populus fremontii ssp. fremontii	1934638.088	6698902.347	3	30,36,25	30	25	27.5	58	
Populus fremontii ssp. fremontii	1934628.128	6698895.418	1	16.5	20	15	17.5	30	
Salix goodingii	1934544.987	6698328.89	2	12,10	12	18	15	25	
Populus fremontii ssp. fremontii	1934538.925	6698251.811	1	7.2	5	5	5	8	
Juglans regia	1934514.242	6698199.415	1	5.4	10	8	9	30	
Juglans regia	1934539.791	6698191.188	1	8	15	15	15	30	
Quercus lobata	1934534.594	6698135.457	1	5	10	10	10	15	
Robinia pseudoacacia	1934515.108	6698085.226	1	8	5	5	5	20	
Populus fremontii ssp. fremontii			1	25	0	0	0	55	dead
Quercus lobata	1934531.563	6697790.768	1	6.5	8	10	9	18	
Quercus lobata	1934517.706	6697751.796	1	13	10	18	14	25	
Fraxinus latifolia	1934531.996	6697743.568	1	7	15	12	13.5	20	
Populus fremontii ssp. fremontii	1934551.915	6697767.385	1	40	0	0	0	38	dead
Fraxinus latifolia	1934541.956	6697720.185	2	6,4	15	15	15	15	
Acer negundo	1934502.55	6697714.123	2	14,12	25	20	22.5	22	
Quercus lobata	1934508.18	6697688.141	1	12.5	15	20	17.5	30	
Acer negundo	1934532.862	6697678.181	1	8	10	20	15	15	
Fraxinus latifolia	1934522.47	6697647.87	3	10,8,8	12	22	17	30	
Salix goodingii	1934507.747	6697664.758	3	6,7,8	10	20	15	22	
Quercus lobata	1934533.728	6697631.415	1	19.5	20	30	25	35	
Robinia pseudoacacia	1934570.585	6699026.624	1	6.6	10	5	7.5	18	
Robinia pseudoacacia	1934573.556	6698921.583	1	6	10	10	10	28	
Robinia pseudoacacia	1934573.293	6698915.702	1	4	10	10	10	22	

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Robinia pseudoacacia	1934574.032	6698917.12	1	8	15	10	12.5	25	
Fraxinus latifolia	1934609.107	6699179.119	1	12	15	20	17.5	12	
Salix goodingii	1934600.641	6699015.51	1	20	30	25	27.5	30	
Populus fremontii ssp. fremontii	1934594.915	6699009.31	1	60	30	20	25	60	
Acer negundo	1934508.257	6698109.921	1	6	10	10	10	30	
Quercus lobata	1934530.558	6698183.289	1	14.5	15	20	17.5	35	
Salix goodingii	1934515.036	6698180.971	1	8	30	10	20	20	recently broken at breast height
Acacia spp.	1934527.036	6698173.791	9	8	20	15	17.5	20	
Quercus lobata	1934497.322	6698177.301	3	18,8,10	20	18	19	35	
Quercus lobata	1934493.336	6698170.536	1	16	20	15	17.5	22	
Quercus lobata	1934492.885	6698142.244	1	10.5	10	12	11	30	
Quercus lobata	1934492.722	6698138.631	1	15.2	15	12	13.5	35	
Robinia pseudoacacia	1934513.365	6698100.654	5	10	15	15	15	30	burned
Robinia pseudoacacia	1934509.34	6698094.007	5	20,6,8,15,8	20	20	20	35	
Robinia pseudoacacia	1934520.986	6698092.995	4	6,6,8,10	10	8	9	28	
Robinia pseudoacacia	1934513.248	6698077.852	1	8	10	10	10	27	
Robinia pseudoacacia	1934522.918	6698069.333	1	6	10	8	9	28	
Robinia pseudoacacia	1934522.52	6698065.106	1	5.5	10	5	7.5	21	
Populus fremontii ssp. fremontii	1934512.889	6697999.525	8	36	30	40	35	58	
Populus fremontii ssp. fremontii	1934515.054	6697987.347	1	25	10	10	10	50	dead top
Populus fremontii ssp. fremontii	1934523.853	6697977.681	2	25,30	10	18	14	50	
Populus fremontii ssp. fremontii	1934512.292	6697966.971	3	30,35,8	20	15	17.5	50	
Populus fremontii ssp. fremontii	1934512.754	6697941.259	6	12,20,33,24,30,20	25	20	22.5	48	
Populus fremontii ssp. fremontii	1934528.832	6697943.415	2	36,25	15	15	15	40	dead top
Populus fremontii ssp. fremontii	1934532.143	6697915.487	1	21.5	10	10	10	45	
Populus fremontii ssp. fremontii	1934523.763	6697912.593	4	20,33,12,35	20	15	17.5	48	
Populus fremontii ssp. fremontii	1934537.183	6697906.371	1	18	10	10	10	45	
Populus fremontii ssp. fremontii	1934527.835	6697887.795	2	21,15	10	12	11	50	
Populus fremontii ssp. fremontii	1934520.45	6697881.423	5	25	20	20	20	40	
Populus fremontii ssp. fremontii	1934520.975	6697872.369	1	30	10	10	10	50	
Populus fremontii ssp. fremontii	1934521.104	6697858.013	4	30,30,15,25	20	15	17.5	55	
Populus fremontii ssp. fremontii	1934527.472	6697844.774	1	30	15	10	12.5	55	
Populus fremontii ssp. fremontii	1934523.964	6697839.212	1	29	15	25	20	45	
Populus fremontii ssp. fremontii	1934541.115	6697843.794	2	20,36	20	15	17.5	45	
Populus fremontii ssp. fremontii	1934528.516	6697859.229	1	19	10	10	10	32	
Populus fremontii ssp. fremontii	1934534.769	6697866.293	2	33,10	10	12	11	30	
Populus fremontii ssp. fremontii	1934531.564	6697876.078	1	20	10	10	10	40	

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populus fremontii ssp. fremontii	1934540.758	6697895.529	1	13.5	10	10	10	35	
Populus fremontii ssp. fremontii	1934530.837	6697882.45	1	24	15	10	12.5	40	
Populus fremontii ssp. fremontii	1934540.146	6697950.778	1	30	20	10	15	40	leaning over water
Populus fremontii ssp. fremontii	1934527.065	6697960.85	1	24	10	10	10	50	
Populus fremontii ssp. fremontii	1934537.909	6697967.991	1	15.5	5	5	5	35	dead top
Populus fremontii ssp. fremontii	1934537.269	6697982.424	1	20	10	12	11	45	
Populus fremontii ssp. fremontii	1934545.885	6697987.401	1	20	15	10	12.5	40	
Populus fremontii ssp. fremontii	1934545.026	6698017.765	1	15	10	12	11	45	
Acer negundo	1934542.346	6698052.763	1	8	8	10	9	10	
Robinia pseudoacacia	1934529.623	6698061.717	1	6	10	8	9	21	
Quercus lobata	1934527.992	6698080.322	1	10.8	15	18	16.5	32	
Populus fremontii ssp. fremontii	1934543.599	6698080.424	1	19	0	0	0	55	dead
Fraxinus latifolia	1934535.877	6698093.356	1	10	20	15	17.5	30	
Acer negundo	1934524.424	6698121.444	1	12	15	10	12.5	10	
Platanus racemosa	1934550.857	6698223.61	1	18	20	15	17.5	35	leaning completely over water
Quercus lobata	1934495.094	6698156.741	1	14.5	20	12	16	25	
Acer saccharinum	1934532.449	6698220.112	6	7	15	20	17.5	25	
Acer saccharinum	1934527.897	6698190.454	3	8,8,6	10	12	11	25	
Acer saccharinum	1934527.018	6698223.464	4	7,12,10,5,5	15	20	17.5	25	
Acer saccharinum	1934526.756	6698199.43	4	8,8,6,4	10	15	12.5	35	
Quercus lobata	1934516.266	6698218.072	1	10	12	12	12	31	
Acer negundo	1934531.962	6698199.419	1	8	20	15	17.5	15	
Acer negundo	1934514.114	6698216.529	1	4.5	12	15	13.5	25	
Fraxinus latifolia	1934543.603	6698198.477	3	7,5,5	20	10	15	15	
Fraxinus latifolia	1934543.603	6698198.477	3	6,4,5	15	15	15	18	over water
Juglans regia	1934498.268	6698221.647	5	10	25	20	22.5	30	
Quercus lobata	1934540.775	6698232.438	1	5	10	8	9	12	
Quercus lobata	1934497.5	6698211.416	2	5,8	8	8	8	15	
Acer saccharinum	1934526.869	6698231.33	1	5	10	12	11	22	
Quercus lobata	1934501.405	6698202.852	1	6.2	10	10	10	30	
Quercus lobata	1934490.46	6698198.276	1	7	10	10	10	25	
Acer saccharinum	1934527.347	6698261.067	2	7,6	10	12	11	30	
Quercus lobata	1934495.851	6698234.561	1	13.5	15	10	12.5	35	
Acer saccharinum	1934526.387	6698275.412	1	10	12	20	16	28	
Quercus lobata	1934498.872	6698242.819	2	14.2,10	25	15	20	32	
Quercus lobata	1934537.727	6698261.838	1	12	12	20	16	30	
Quercus lobata	1934501.23	6698258.339	3	20,20,6	15	18	16.5	35	

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Populus fremontii ssp. fremontii	1934545.782	6698276.629	1	40	10	10	10	45	dying
Quercus lobata	1934497.462	6698285.401	1	17.5	20	18	19	30	
Quercus lobata	1934502.026	6698295.641	1	5.5	8	8	8	15	
Quercus lobata	1934504.977	6698304.881	1	4	10	10	10	12	
Quercus lobata	1934499.14	6698300.749	2	9,9	20	10	15	28	
Juglans regia	1934501.993	6698316.616	6	10	15	20	17.5	23	
Acer negundo	1934530.134	6698303.922	3	10,12,8	15	15	15	30	
Acer negundo	1934533.38	6698341.944	1	6.7	15	10	12.5	18	
Acer negundo	1934540.923	6698346.351	7	8	20	25	22.5	25	
Juglans regia	1934512.516	6698329.646	4	8,6,6,4	12	15	13.5	22	
Juglans regia	1934533.036	6698368.88	2	13,11	30	18	24	30	
Juglans regia	1934518.051	6698381.771	4	7,10,9,8.5	20	30	25	30	
Acer negundo	1934536.456	6698378.204	1	8	15	30	22.5	25	
Quercus lobata	1934518.938	6698402.121	1	5.3	10	10	10	20	
Quercus lobata	1934550.972	6698374.946	1	4.2	10	10	10	20	
Salix goodingii	1934550.972	6698374.946	6	8,8,5,5,5,?	12	10	11	15	
Quercus lobata	1934539.596	6698401.705	1	15.2	30	20	25	40	
Acer saccharinum	1934557.642	6698399.094	5	7.6,6,5,5,5	20	15	17.5	35	
Acer saccharinum	1934554.664	6698402.952	2	10,9.6	20	15	17.5	30	
Quercus lobata	1934543.158	6698426.663	1	15.5	30	20	25	45	
Acer saccharinum	1934555.338	6698407.625	2	8,4	30	15	22.5	22	
Acer saccharinum	1934558.868	6698410.408	2	5.7,4	20	12	16	26	
Acer negundo	1934545.117	6698451.777	1	11	20	10	15	35	
Acer saccharinum	1934574.676	6698419.856	4	6,6,6,6	10	15	12.5	25	
Acer negundo	1934556.199	6698438.538	3	6,6,8	40	20	30	20	
Acer negundo	1934556.199	6698438.538	4	6,4,10,8	30	35	32.5	30	
Acer negundo	1934565.765	6698423.608	1	4.1	10	10	10	30	
Acer saccharinum	1934566.889	6698432.233	3	12,6,6	20	20	20	32	
Salix goodingii	1934565.187	6698464.634	12	8	25	35	30	20	
Acer saccharinum	1934573.098	6698434.309	1	4.2	20	10	15	25	
Salix goodingii	1934567.977	6698459.902	2	10,8	15	30	22.5	25	
Salix goodingii	1934580.803	6698442.784	6	10	15	15	15	18	
Quercus lobata	1934547.136	6698468.834	1	12.6	15	12	13.5	35	
Salix goodingii	1934564.746	6698501.185	3	8,10,5	10	20	15	20	
Acer negundo	1934572.88	6698537.355	7	10	25	32	28.5	18	
Acer saccharinum	1934573.62	6698493.544	12	8	30	20	25	25	
Acer negundo	1934572.526	6698552.099	8	20,20,20,10,10,5,?,?	40	15	27.5	20	

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Fraxinus latifolia	1934580.631	6698474.705	1	9.7	15	12	13.5	25	
Acer negundo	1934589.744	6698561.407	4	12,10,8,4	15	9	12	20	large clump
Salix goodingii	1934588.258	6698512.409	1	10	20	10	15	15	
Acer negundo	1934570.538	6698574.57	4	6,12,12,8	20	30	25	30	
Acer negundo	1934567.924	6698548.513	1	11.8	35	10	22.5	15	
Acer negundo	1934563.134	6698577.01	2	10,6	20	10	15	20	
Acer negundo	1934580.469	6698590.445	4	6,12,10,6	10	10	10	28	
Quercus lobata	1934550.055	6698609.203	1	30	20	22	21	35	
Acer negundo	1934594.336	6698614.246	1	10	2	2	2	25	almost dead
Quercus lobata	1934560.913	6698628.989	2	18,20.8	20	35	27.5	42	
Acer negundo	1934564.651	6698620.824	1	3.6	10	10	10	12	
Quercus lobata	1934599.446	6698653.449	1	20	20	30	25	35	
Acer negundo	1934576.017	6698640.685	2	6,10	15	12	13.5	20	
Acer negundo	1934594.036	6698662.653	1	8	10	12	11	18	
Quercus lobata	1934595.806	6698695.361	1	9.6	12	18	15	30	
Acer negundo	1934576.735	6698697.489	1	8	10	12	11	20	
Acer negundo	1934603.594	6698687.369	2	6,10	20	15	17.5	15	
Acer negundo	1934572.905	6698695.136	2	6,6.5	15	12	13.5	18	
Populus fremontii ssp. fremontii	1934604.45	6698694.594	1	15	20	28	24	40	
Acer negundo	1934564.717	6698699.645	1	4.2	8	10	9	15	
Fraxinus latifolia	1934609.233	6698719.088	4	4,8,6,6	20	25	22.5	20	
Quercus lobata	1934561.548	6698707.419	1	10	20	18	19	22	
Populus fremontii ssp. fremontii	1934599.512	6698726.073	1	18	15	20	17.5	40	
Quercus lobata	1934555.776	6698718.772	1	7.7	10	20	15	38	
Populus fremontii ssp. fremontii	1934598.834	6698760.056	3	24,12,20	20	18	19	50	
Quercus lobata	1934565.652	6698720.745	1	8.2	20	15	17.5	42	
Populus fremontii ssp. fremontii	1934597.593	6698770.467	2	12,10	10	10	10	18	
Quercus lobata	1934572.901	6698720.365	1	18.5	30	30	30	40	
Populus fremontii ssp. fremontii	1934590.276	6698775.093	1	20	20	10	15	40	
Acer negundo	1934576.048	6698737.04	1	4.5	10	10	10	19	
Alnus rhombifolia	1934585.428	6698812.044	1	8.5	10	30	20	15	
Alnus rhombifolia	1934597.406	6698823.418	1	6	20	15	17.5	12	
Alnus rhombifolia	1934594.572	6698829.033	1	13.8	20	10	15	15	
Quercus lobata	1934574.971	6698750.121	1	12.5	20	10	15	40	
Acer negundo	1934574.971	6698750.121	4	8,8,6,6	30	20	25	25	
Alnus rhombifolia	1934594.605	6698832.753	1	6.2	15	10	12.5	20	
Quercus lobata	1934565.132	6698760.608	1	5.5	20	15	17.5	20	

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Alnus rhombifolia	1934595.579	6698842.32	1	6	10	8	9	25	
Quercus lobata	1934558.273	6698749.318	1	12	20	20	20	45	
Alnus rhombifolia	1934588.933	6698845.797	3	12,8,6	20	15	17.5	35	
Alnus rhombifolia	1934595.857	6698857.254	1	8.5	10	10	10	30	
Alnus rhombifolia	1934576.369	6698825.041	7	36,36,12,12,10,12,6	40	35	37.5	55	
Populus fremontii ssp. fremontii	1934599.839	6698865.562	1	6	20	30	25	40	
Alnus rhombifolia	1934579.501	6698845.272	1	27	40	30	35	50	
Populus fremontii ssp. fremontii	1934594.191	6698876.682	4	36,40,30,15	50	30	40	50	
Populus fremontii ssp. fremontii	1934596.999	6698889.446	2	36,30	30	35	32.5	40	
Populus fremontii ssp. fremontii	1934599.814	6698895.380	3	30,25,18	30	30	30	50	
Alnus rhombifolia	1934549.255	6698796.046	1	12	30	15	22.5	25	
Quercus lobata	1934531.707	6698509.096	1	6.5	30	15	22.5	40	
Gleditsia triacanthos	1979519.254	6691168.416	5	11.5,11.2,6.8,7,5.5	15	20	17.5	30	
Quercus lobata	1979525.447	6691116.809	1	6.5	10	8	9	22	
Juglans regia	1979537.833	6691097.542	1	11.5	20	10	15	28	
Quercus lobata	1979548.155	6691113.368	1	5.5	10	10	10	12	
Salix goodingii	1979676.83	6690784.456	1	6	5	5	5	10	
Prunus dulcis	1979638.434	6690741.381	12	8	10	30	20	15	
Prunus dulcis	1979650.131	6690724.866	4	6	10	10	10	15	
Fraxinus latifolia	1979650.131	6690700.095	1	6	10	10	10	20	
Quercus lobata	1979677.655	6690647.111	1	12	10	18	14	35	
Quercus lobata	1979684.536	6690627.844	2	9,6.5	15	15	15	20	
Quercus lobata	1979692.105	6690599.632	2	22,10	20	15	17.5	30	
Quercus lobata	1979730.639	6690485.407	1	5.5	6	8	7	12	
Quercus agrifolia	1979745.777	6690485.407	2	6,5	15	15	15	15	
Populus fremontii ssp. fremontii	1979634.583	6690832.912	3	30,14,10	20	20	20	50	
Populus fremontii ssp. fremontii	1979639.273	6690844.542	1	10.5	10	10	10	20	
Quercus lobata	1979585.864	6690956.073	1	10	10	20	15	20	
Gleditsia triacanthos	1979567.469	6690983.453	3	6.5,6.7	15	20	17.5	20	
Quercus lobata	1979575.655	6690942.195	2	9.5,6.5	10	20	15	15	
Quercus lobata	1979605.738	6690918.178	2	18,8.5	20	30	25	25	
Populus fremontii ssp. fremontii	1979641.982	6690827.245	1	30	20	20	20	50	
Populus fremontii ssp. fremontii	1979665.427	6690795.953	1	24	15	20	17.5	55	
Fraxinus latifolia	2000773.665	6675211.912	1	5	10	15	12.5	25	
Quercus lobata	2000780.294	6675184.291	3	10,30,24	50	35	42.5	60	
Fraxinus latifolia	2000760.407	6675190.368	1	9	30	25	27.5	40	
Quercus lobata	2000749.359	6675148.937	1	16	15	10	12.5	20	

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Quercus lobata	2000767.036	6675137.337	1	33	60	20	40	50	
Fraxinus latifolia	2000791.342	6675135.127	1	7.5	30	10	20	30	
Quercus lobata	2000790.789	6675167.719	1	5	5	12	8.5	15	
Quercus lobata	2000775.322	6675158.88	3	14,12,9	40	25	32.5	35	
Fraxinus latifolia	2001140.629	6674953.993	1	24	40	35	37.5	40	
Quercus lobata	2001189.793	6674942.392	1	3	5	5	5	15	
Quercus lobata	2001410.977	6674776.338	1	6	5	5	5	15	
Quercus lobata	2001407.11	6674773.024	1	6	5	5	5	15	
Quercus lobata	2001402.691	6674768.052	1	6	5	5	5	15	
Quercus lobata	2001408.768	6674759.766	1	6	5	5	5	15	
Quercus lobata	2001417.606	6674765.843	1	8	10	15	12.5	20	
Salix goodingii	2001417.606	6674759.214	1	7	25	15	20	20	
Quercus lobata	2001425.34	6674775.786	1	9	10	15	12.5	25	
Juglans regia	2001430.864	6674766.395	1	20	10	10	10	30	
Quercus lobata	2001446.331	6674774.129	1	12	10	25	17.5	25	
Juglans regia	2001433.074	6674779.1	1	19	40	30	35	55	
Juglans regia	2001445.779	6674784.072	9	9	25	35	30	25	
Juglans regia	2001447.989	6674760.871	1	13.5	25	15	20	30	
Juglans regia	2001456.827	6674771.367	1	9.2	10	20	15	15	
Juglans regia	2001465.113	6674764.738	1	13.8	15	15	15	25	
Juglans regia	2001462.904	6674752.585	1	9.8	25	10	17.5	20	
Juglans regia	2001445.779	6674737.117	1	10.5	20	15	17.5	30	
Juglans regia	2001452.408	6674727.174	1	5.5	5	10	7.5	15	
Juglans regia	2001453.513	6674741.537	1	5.8	5	10	7.5	15	
Juglans regia	2001468.98	6674737.117	1	6.3	10	15	12.5	20	
Juglans regia	2001474.504	6674740.984	1	5.5	10	10	10	15	
Juglans regia	2001480.581	6674736.013	1	6.6	20	10	15	20	
Juglans regia	2001471.19	6674707.84	1	5	5	10	7.5	20	
Juglans regia	2001483.343	6674702.868	1	9	10	15	12.5	30	
Juglans regia	2001476.161	6674713.916	1	5	10	10	10	15	
Juglans regia	2001477.266	6674720.545	1	7.5	5	10	7.5	25	
Juglans regia	2001485	6674722.755	1	11.7	10	20	15	20	
Quercus lobata	2001494.391	6674733.803	1	11	10	10	10	25	
Quercus lobata	2001510.963	6674723.307	1	10	12	10	11	18	
Quercus lobata	2001523.668	6674715.021	1	9	8	5	6.5	10	
Fraxinus latifolia	2001515.382	6674706.183	2	4,6	10	20	15	10	
Juglans regia	2001515.382	6674694.03	1	7	15	20	17.5	30	

Scientific name	Northing	Easting	Number trunks	DBH (in)	Dripline diameter max X (ft)	Dripline diameter max Y (ft)	Mean dripline diameter (ft)	Est. Height (ft)	Notes, tree health, general condition (i.e., vigor)
Juglans regia	2001569.518	6674685.743	1	7	10	15	12.5	20	
Juglans regia	2001543.003	6674675.248	1	5	5	10	7.5	15	
Juglans regia	2001510.411	6674684.086	1	5	8	15	11.5	15	
Juglans regia	2001597.47	6674615.588	1	7	15	20	17.5	35	
Juglans regia	2001602.994	6674629.95	1	49	45	30	37.5	40	possibly dead
Quercus lobata	2001667.073	6674613.378	1	14	20	20	20	55	
Quercus lobata	2001673.702	6674586.863	1	9	35	20	27.5	40	
Quercus lobata	2001698.561	6674584.1	1	18	20	25	22.5	35	
Juglans regia	2001700.218	6674554.823	1	10	10	20	15	20	
Quercus lobata	2001582.555	6674631.608	1	6	10	15	12.5	30	
Quercus lobata	2001616.252	6674616.693	1	9	20	10	15	30	
Juglans regia	2001620.671	6674632.712	1	33	35	40	37.5	40	possibly dead
Juglans regia	2001653.816	6674594.596	1	8	20	10	15	20	
Juglans regia	2001679.779	6674605.644	1	6	15	15	15	25	
Juglans regia	2001684.198	6674566.976	1	10	10	15	12.5	20	
Fraxinus latifolia	2001724.524	6674574.71	3	6,8,6	15	20	17.5	15	
Fraxinus latifolia	2001715.685	6674549.851	1	10	20	20	20	20	
Quercus lobata	2001688.617	6674575.814	1	40	35	60	47.5	55	
Juglans regia	2001712.371	6674592.387	1	9	10	10	10	15	
Juglans regia	2001712.371	6674574.157	1	7	15	25	20	20	
Quercus lobata	2000906.881	6675106.615	1	34	45	30	37.5	50	
Quercus lobata	2000897.702	6675083.635	1	11	10	12	11	25	
Fraxinus latifolia	2000916.987	6675093.133	3	7.3,8.5,6.2	15	30	22.5	20	
Quercus lobata	2000912.587	6675074.919	2	14,10	45	30	37.5	40	
Quercus lobata	2000940.678	6675102.551	1	9	30	20	25	25	
Juglans regia	2001069.577	6675011.838	4	5,4,6,6	35	20	27.5	35	
Quercus lobata	2001087.04	6674991.63	2	14,14	30	20	25	35	
Juglans regia	2001091.122	6674992.419	1	6	5	5	5	12	
Juglans regia	2001115.111	6674984.663	1	16	45	20	32.5	40	
Juglans regia	2001109.737	6674973.791	1	8	10	10	10	20	
Fraxinus latifolia	2001100.005	6674979.74	1	7	15	10	12.5	30	
Juglans regia	2001114.438	6674968.925	1	5	10	8	9	25	
Juglans regia	2001123.112	6674967.412	1	7	10	10	10	30	
Juglans regia	2001134.127	6674964.722	1	8	15	8	11.5	30	
Juglans regia	2001138.026	6674961.526	1	8	20	15	17.5	25	
Juglans regia	2001141.04	6674963.278	1	15	20	15	17.5	40	
Juglans regia	2001126.363	6674986.87	1	40	35	15	25	45	

Scientific name	Northing	Easting	Number trunks	DBH (in)	Dripline diameter max X (ft)	Dripline diameter max Y (ft)	Mean dripline diameter (ft)	Est. Height (ft)	Notes, tree health, general condition (i.e., vigor)
Juglans regia	2001174.298	6674957.142	1	13	30	15	22.5	30	
Quercus lobata	2001196.189	6674946.402	1	11	20	15	17.5	25	
Juglans regia	2000995.842	6675056.124	3	6,8,5	20	15	17.5	30	
Quercus lobata	2000990.45	6675062.189	4	4,6,5,6	20	10	15	20	
Juglans regia	2000987.369	6675047.544	1	5	10	15	12.5	25	
Juglans regia	2000988.872	6675050.492	1	7	8	15	11.5	35	
Juglans regia	2000986.759	6675051.131	1	6	15	15	15	30	
Juglans regia	2000988.056	6675052.868	1	9	10	20	15	35	
Quercus lobata	2000956.592	6675067.582	2	8,7	20	30	25	20	
Juglans regia	2000956.902	6675068.583	1	11	25	40	32.5	40	
Quercus lobata	2001172.733	6674909.711	1	30	30	30	30	40	
Quercus lobata	2001208.744	6674920.278	2	7,6	10	15	12.5	25	
Quercus lobata	2001212.825	6674921.494	1	15	25	20	22.5	25	
Quercus lobata	2001212.181	6674923.596	1	8	15	10	12.5	15	
Populus fremontii ssp. fremontii	2001145.275	6674930.643	3	13.8,9,6	25	15	20	35	
Juglans regia	2001231.941	6674908.319	3	4	20	10	15	20	
Quercus lobata	2001238.395	6674906.693	1	8.8	15	10	12.5	25	
Quercus lobata	2001241.85	6674901.617	1	21.4	35	20	27.5	45	
Juglans regia	2001246.69	6674893.12	1	9.4	15	10	12.5	25	
Quercus lobata	2001255.502	6674897.618	1	5.5	10	20	15	20	
Quercus lobata	2001264.191	6674894.064	1	30	25	20	22.5	40	possibly dead
Juglans regia	2001257.456	6674883.251	1	12.8	10	15	12.5	30	
Juglans regia	2001261.721	6674883.102	1	8	12	10	11	15	
Juglans regia	2001261.117	6674881.206	1	11	15	10	12.5	25	possibly dead
Juglans regia	2001262.745	6674877.73	1	14.2	10	10	10	20	
Juglans regia	2001264.014	6674880.732	1	11.5	10	5	7.5	35	possibly dead
Juglans regia	2001265.831	6674877.499	1	11.5	15	20	17.5	30	
Juglans regia	2001267.033	6674879.059	1	3.5	10	10	10	15	
Juglans regia	2001271.373	6674881.37	1	12.4	20	15	17.5	20	possibly dead
Juglans regia	2001275.598	6674870.909	1	11.9	25	20	22.5	40	
Juglans regia	2001301.235	6674861.949	4	16,7.2,8,7.5	30	25	27.5	30	
Juglans regia	2001223.827	6674888.468	6	4	15	25	20	20	
Juglans regia	2001296.705	6674852.168	1	8	10	5	7.5	15	
Juglans regia	2001306.939	6674847.937	2	8	20	15	17.5	15	
Quercus lobata	2001338.774	6674835.462	1	20	30	25	27.5	50	
Juglans regia	2001362.649	6674824.699	4	36,30,20,25	35	30	32.5	40	
Quercus lobata	1857719.184	6678640.246	1	28	45	30	37.5	60	

Scientific name	Northing	Easting	Number trunks	DBH (in)	Dripline diameter max X (ft)	Dripline diameter max Y (ft)	Mean dripline diameter (ft)	Est. Height (ft)	Notes, tree health, general condition (i.e., vigor)
Fraxinus latifolia	2041745.549	6677349.205	5	8-12	20	25	22.5	20	
Quercus lobata	2041865.604	6677265.482	2	8,10	8	10	9	25	
Quercus lobata	2041909.521	6677235.139	2	12,10	15	20	17.5	28	
Populus fremontii ssp. fremontii	2041875.585	6677249.912	2	48,18	20	40	30	50	poison oak
Quercus lobata	2042940.467	6676737.393	1	12	20	20	20	40	
Quercus lobata	2042680.536	6676872.978	1	18	15	20	17.5	30	
Quercus lobata	2042660.446	6676899.715	1	10	10	30	20	40	
Quercus lobata	2042651.636	6676885.477	1	9	15	20	17.5	15	
Fraxinus latifolia	2042656.186	6676885.141	1	8	30	20	25	20	
Quercus lobata	2042643.837	6676895.282	1	30	30	35	32.5	45	
Quercus lobata	2042633.7	6676920.161	1	36	30	30	30	50	
Quercus lobata	2042597.749	6676925.22	1	20	10	25	17.5	35	
Quercus lobata	2042791.756	6676810.71	1	15	15	20	17.5	25	
Quercus lobata	2042764.713	6676821.607	2	35,20	20	35	27.5	35	35 in trunk is dead
Populus fremontii ssp. fremontii	2042629.76	6676893.977	1	10	10	15	12.5	30	
Quercus lobata	2042592.005	6676918.12	1	10	15	30	22.5	30	
Quercus lobata	2042594.663	6676908.32	1	15	10	20	15	25	
Quercus lobata	2042589.339	6676914.359	1	25	10	10	10	30	
Quercus lobata	2042518.149	6676982.712	2	12.3,6.5	20	15	17.5	30	
Quercus lobata	2042510.034	6676983.421	1	7.5	15	15	15	30	
Quercus lobata	2042493.489	6676984.452	1	8	10	10	10	30	
Populus fremontii ssp. fremontii	2042477.486	6676975.489	1	10	8	8	8	20	
Quercus lobata	2042483.841	6676974.577	1	6	10	10	10	20	
Quercus lobata	2042491.32	6677000.956	1	22	40	30	35	45	
Quercus lobata	2042475.047	6677003.731	1	18	30	35	32.5	50	
Quercus lobata	2042468.658	6677006.731	1	28	30	40	35	50	
Quercus lobata	2042460.816	6677000.647	1	20	20	30	25	50	
Quercus lobata	2042453.951	6677005.368	1	6	10	10	10	20	
Quercus lobata	2042427.394	6677013.842	1	15	20	30	25	60	
Quercus lobata	2042212.934	6677144.191	1	15.5	15	30	22.5	30	
Quercus lobata	2042265.475	6677117.643	1	15.3	20	40	30	50	
Quercus lobata	2042022.097	6677243.696	1	50	45	38	41.5	55	
Populus fremontii ssp. fremontii	2042277.695	6677081.632	3	20,12,12	15	40	27.5	40	
Quercus lobata	2042317.931	6677052.351	1	20	40	30	35	50	
Quercus lobata	2042322.382	6677044.129	2	35,40	50	25	37.5	45	
Quercus lobata	2042335.317	6677038.624	2	38,10	15	50	32.5	45	
Populus fremontii ssp. fremontii	2042366.012	6677033.49	1	9	30	10	20	40	

Scientific name	Northing	Easting	Number trunks	DBH (in)	Dripline diameter max X (ft)	Dripline diameter max Y (ft)	Mean dripline diameter (ft)	Est. Height (ft)	Notes, tree health, general condition (i.e., vigor)
Quercus lobata	2041952.38	6677295.539	1	51.3	60	60	60	65	
Quercus lobata	2041886.135	6677263.079	1	16	30	30	30	30	poison oak
Quercus lobata	2042142.023	6677126.079	3	8,10,20	20	35	27.5	45	
Quercus lobata	2042119.22	6677133.883	1	5.5	10	10	10	15	
Quercus lobata	2042094.654	6677158.249	1	46	40	45	42.5	40	
Fraxinus latifolia	2042093.537	6677147.141	12	8-12	15	45	30	15	
Quercus lobata	2042064.524	6677172.617	1	36	40	40	40	60	
Quercus lobata	2042357.277	6677021.209	2	12,12	15	10	12.5	20	
Fraxinus latifolia	2042364.802	6677023.639	3	10-12	20	20	20	-	
Quercus lobata	2042156.358	6677111.378	1	18	20	15	17.5	50	
Quercus lobata	2041994.227	6677218.162	1	30.8	50	40	45	50	
Quercus lobata	2041961.066	6677236.903	2	12,6	10	20	15	30	
Quercus lobata	2041901.3	6677260.906	1	10	10	20	15	35	poison oak
Quercus lobata	2041892.22	6677258.614	1	12	20	10	15	30	poison oak

Appendix D

Clean Water Act 401 Water Quality Certification Application

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

SECTION 401 WATER QUALITY CERTIFICATION
APPLICATION FORM

A fee of $40,500 is included with this application as required by 23 CCR §3833b(2)(A) and by 23 CCR § 2200(e). The total fee includes the required $500 base price plus the maximum dredge and fill operation fee of $40,000, as indicated by the fee calculator at http://www.waterboards.ca.gov/cwa401/docs/dredgefillfeecalculator.xls

1. APPLICANT INFORMATION	**2. AGENT INFORMATION***
Applicant: US Army Corps of Engineers	Agent*
Contact Name: Don Lash	Contact Name:
Address: 1325 J Street	Address:
Sacramento, CA 95814	
Phone No: 916-557-6742	Phone No:
Fax No: 916-557-7856	Fax No:

*Complete only if applicable

3. PROJECT DESCRIPTION

a) Project Title: **Sacramento River Bank Protection Project Priority Sites, River Miles:** Sacramento River at 16.9 Left, 33.0 Right, 33.3 Right, 43.7 Right, 44.7 Right, 47.0 Left, 47.9 Right, 48.2 Right, 62.5 Right, 68.9 Left, and 78.0 Left; Steamboat Slough at 19.0 Right, 19.4 Right, and 22.7 Right.

b) Project Location:

Sacramento River Locations

Site:	Street Location	Latitude	Longitude
RM 16.9	Highway 160 and Terminus Rd, Isleton, CA	-121.6164	38.1629
RM 33.0	Highway 160 and Courtland Rd Paintersville, CA	-121.5786	38.3138
RM 33.3	Highway 160 and Sutter Island Rd, Paintersville, CA	-121.5784	38.3194
RM 43.7	South River Rd and Rose Rd, Clarksburg, CA	-121.5231	38.4355
RM 44.7	South River Rd and Freeport Bridge., Clarksburg, CA	-121.5067	38.4384
RM 47.0	South River Rd and Freeport Bridge, Freeport, CA	-121.5201	38.4715
RM 47.9	South River Rd and Freeport Bridge, Freeport, CA	-121.5243	38.4736
RM 48.2	North Harbor Blvd and Riverbank Rd, Freeport, CA	-121.5481	38.4733
RM 62.5	Garden Highway and Powerline Rd, Lovdal, CA	-121.6045	38.5975

RM 68.9	Garden Highway and West Riego Rd, Vin, CA	-121.5963	38.6575
RM 78.0	South River Rd and Freeport Bridge, Joe's Landing, CA	-121.5201	38.7708

Steamboat Slough Locations

Site:	Street Location	Latitude	Longitude
RM 19.0	Ryer Rd East and Snug Harbor Dr, Walker Landing, CA	38.2166	-121.6062
RM 19.4	Ryer Rd East and Highway 220, Walker Landing, CA	38.2204	-121.6035
RM 22.7	Sutter Island Rd and West Sutter Island Cross Rd, Howard Landing, CA	38.2624	-121.5920

c) Project Description: *(include purpose and final goal)*:
The U.S. Army Corps of Engineers (Corps) and the State of California Reclamation Board (Reclamation Board) propose to implement bank protection measures to prevent ongoing streambank erosion at 14 priority sites along the Sacramento River and Steamboat Slough. The 14 sites are River Miles (RM) 16.9L, 33.0R, 33.3R, 43.7R, 44.7R, 47.0L, 47.9R, 48.2R, 62.5R, 68.9L, 78.0L along the Sacramento River in Yolo, Sacramento, and Sutter counties and RM 19.0R, 19.4R, and 22.7R along the Steamboat Slough in Solano and Sacramento counties. These 14 sites are among 24 critical erosion sites in Governor Schwarzenegger's February 24, 2006 Declaration of State of Emergency of California Levee System and March 7, 2006 Executive Order S-01-06. Erosion into the banks at these sites requires immediate work to prevent levee failure.

Bank protection measures will be implemented at each of the14 sites and, in total, the overall project would generally consist of: (1) reinforcement of the bank toes with riprap; (2) placement of a mixture of riprap and soil (mixture of sand and silt suitable for plant growth) on tops of the lower banks riprap to create riparian benches above the MSWL; (3) placement of riprap and soil along the upper banks; and (4) planting the lower banks, benches and upper banks with vegetation to provide bank stabilization and riparian habitat. Ten of the 14 sites (Sacramento River at RM 33.0R, 33.3R, 43.7R, 44.7R, 47.0L, 47.9R, 48.2R, 62.5R, 68.9L, 78.0L) will have instream wood material (IWM) anchored on the tops of riparian benches; the benches will be designed to be barely wet at winter/spring average flows.

The construction will occur in two phases. Phase 1 construction will occur during Fall 2006 and Winter 2007; all work will be on the waterside of the riverbank from a barge. During Phase 2, which will occur during Spring and Summer 2007, construction at six sites will occur from landside (Sites RM 47.0L, 47.9R, 48.2R, 62.5R, 68.9L, and 78.0L). These six erosion sites are adjacent to wide grassy areas that can support all construction-related activities and equipment staging. The Phase 2 activities at the remaining sites on the Sacramento River (sites RM 16.9L, 33.0R, 33.3R, 43.7R, and 44.7R) and all sites on Steamboat Slough (Sites RM 19.0R, 19.4R, and

22.7R) will be from the waterside. For all waterside construction, the contractor would use adjacent landside areas for staging of vehicles and plant materials and other associated construction equipment as necessary.

The bank protection measures summarized for the entire project (14 site totals) consist of: (1) reinforcement of the bank toe with a total of 9,817 linear feet (LF) of riprap covering an area of 359,263 square feet (8.5 acres); (2) placement of a mixture of soil and rock on top of the toe riprap to create a bench at approximately MSWL, and extending along the upper slope, covering a total area of 567,767 square feet (13.4 acres); (4) planting the lower bank, riparian bench and upper slope with vegetation to provide bank stabilization and riparian habitat; and (5) anchoring instream woody materials (IWM) along approximately 7,705 LF the waterside edge of the riparian bench to provide aquatic habitat.

A total of approximately 213,926 cubic yards of riprap and soil-rock mix would be placed along the embankment. The total surface area of these materials would be about 927,030 square feet (21.8 acres). Approximately 359,263 square feet (8.5 acres) of this area would be below the mean summer water line.

d) Proposed Schedule: *(start-up, duration, and completion dates)*: Phase 1 - November 13, 2006 through June 1, 2007. Phase 2 - June 1, 2007 through November 30, 2007.

e) Total Project size: *(clearing, grading, other construction activities)*
21.8 acres 9,817 linear feet *(if appropriate)*

4. IMPACTED WATER BODIES

a) Name*(s)* of Receiving Water Body*(ies)*: Sacramento River and Steamboat Slough

b) Anticipated potential stream flow during project activity: Phase I - Between 6,000 cfs and 16,000 cfs at late-fall to summer flows at the four most downstream sites (RM 16.9L, 19.0R, 19.4R, and 22.7R); between 6,000 cfs and 16,000 cfs at the seven sites in the mid-reaches (Sites RM 33.0R, 33.3R, 43.7R, 44.7R, 47.0L, 47.9R, and 48.2R); and, between 10,000 cfs and 30,000 cfs at the three most upstream sites (RM 62.5R, 68.9L, and 78.0L). Phase II - Between 6,000 cfs and 10,000 cfs at summer to fall flows at the four most downstream sites (RM 16.9L, 19.0R, 19.4R, and 22.7R); between 6,000 cfs and 9,000 cfs at the seven sites in the mid-reaches (Sites RM 33.0R, 33.3R, 43.7R, 44.7R, 47.0L, 47.9R, and 48.2R); and, between 10,000 cfs and 15,000 cfs at the three most upstream sites (RM 62.5R, 68.9L, and 78.0L).

c) Describe potential impacts to water quality:
The placement of riprap during construction activities within the channel would temporarily generate increased turbidity in the immediate vicinity of the project area. The placement of riprap on the toe to the water surface could result in a plume of sediments generated from the channel bottom and the channel side, becoming suspended in the water and could generate turbidity levels above those identified as acceptable by the Basin Plan. For landside construction (Sites RM 47.0L, 47.9R, 48.2R, 62.5R, 68.9L, and 78.0L), water quality impacts would be constrained to the temporary turbidity increases for riprap placement. Waterside

construction (Sites RM 16.9L, 19.0R, 19.4R, 22.7R, 33.0R, 33.3R, 43.7R, 44.7R) would also include the potential for additional turbidity impacts from wave action generated during boat and barge operations. Other potential impacts include releases of small volumes of petroleum products (fuel, engine oil, and hydraulic line oil) due to their use in close proximity to the local receiving waters downstream of the projects sites.

d) Indicate in ACRES and LINEAR FEET *(where appropriate)* the proposed **waters of the United States** to be impacted by any discharge other than dredging, and identify the impacts*(s)* as permanent and/or temporary for each water body type listed below:

Water Body Type	**Permanent Impacts**		**Temporary Impacts**	
	(acres)	**(linear feet)**	**(acres)**	**(linear feet)**
Jurisdictional Wetland				
Riparian			6.1	9,817
Streambed unvegetated	7.9		7.8	9,817
Lake & Reservoir				

e) Indicate the volume of dredged material (cubic yards) to be discharged to waters of the United States: Small amounts of sand may be dredged from mid-channel locations adjacent to proposed wetland benches at 5 of the 14 priority erosion sites, including Sacramento River Sites RM 16.9L, 43.7 as well as Steamboat Slough Sites RM 19.0R, 19.4R and 22.7R.

f) Indicate type(s) of material proposed to be discharged to waters of the United States: This project would use approximately 116,744 cubic yards of riprap rock revetment (D50 of 12 inches) placed below the summer water surface, with a mixture of 97,181 cubic yards of rock (D50 of 8 inches) and soil (a mixture of sand and silt suitable for plant establishment and growth) placed along the riparian benches and upper slopes. The rock and soil mixture may be covered with a biodegradable coir fabric to prevent soil loss during the first high water before vegetation has established. Sand will be placed on top of wetland benches at 5 of the 14 priority erosion sites, including Sacramento River Sites RM 16.9L, 43.7 as well as Steamboat Slough Sites RM 19.0R, 19.4R and 22.7R.

5. COMPENSATORY MITIGATION

a) Indicate in ACRES and LINEAR FEET *(where appropriate)* the total quantity of **waters of the United States** proposed to be Created, Restored and/or Enhanced for purposes of providing Compensatory Mitigation: On-site mitigation/restoration

Water Body Type	**Created**		**Restored**		**Enhanced**	
	(acres)	**(linear ft)**	**(acres)**	**(linear ft)**	**(acres)**	**(linear ft)**
Jurisdictional Wetland	0.7	2,346				

Riparian	7.3	9,817				
Streambed						
Lake/Reservoir						

b) If contributing to a Mitigation or Conservation Bank, indicate the agency, dollar amount, acreage, and water body type *(if applicable)*: Not applicable.
Conservation Agency
____
$__________ for_______ acres of ___________________________________ *(water body type)*
How many acres of this mitigation area qualify as waters of the United States?____________

c) Other Mitigation *(omit if not applicable)*: Not applicable.

How many acres of this mitigation area qualify as waters of the United States?____________

d) Location of Compensatory Mitigation Site*(s)*:
Created riparian habitat (e.g. riparian benches) is proposed at all 14 priority erosion sites (see 3b for locations). Created wetland habitat is proposed at 5 of the 14 priority erosion sites, including Sacramento River sites RM 16.9L, 43.7 as well as Steamboat Slough sites RM 19.0R, 19.4R and 22.7R.

6. OTHER ACTIONS/BEST MANAGEMENT PRACTICES (BMPs)

Briefly describe other actions/BMPs to be implemented to Avoid and/or Minimize impacts to waters of the United States, including preservations of habitats, erosion control measures, project scheduling, flow diversions, etc.: The Corps would implement a Storm Water Pollution Prevention Plan before and during construction to minimize turbidity generating activities. The Corps will monitor turbidity and settleable solids to avoid violation of basin standards. The contractor would be required to develop and implement a hazardous materials management plan prior to initiation of construction. The plan would include best management practices to (1) reduce the likelihood of spills of toxic chemicals and other hazardous materials during construction, (2) describe a specific protocol for the proper handling and disposal of materials and contingency procedures to follow in the event of an accidental spill, and (3) describe a specific protocol for the proper handling and disposal of materials should materials be encountered during construction.

The specific BMPs that will be incorporated into the SWPPP will be determined during the final stages of project design. However, the SWPPP is likely to include one or more of the following standard practices, which are commonly used during the construction and postconstruction phases of levee improvement projects:

- Stage construction equipment and materials on the landside of the subject levee reaches. To the extent possible, stage equipment and materials in areas that have already been disturbed.

- Minimize ground and vegetation disturbance during project construction by establishing designated equipment staging areas, ingress and egress corridors, spoils disposal and soil stockpile areas, and equipment exclusion zones prior to the commencement of any grading operations.
- Stockpile soil and grading spoils on the landside of the subject levee reaches, and install sediment barriers (e.g., silt fences, fiber rolls, straw bales) around the base of stockpiles to intercept runoff and sediment during storm events. If necessary, cover stockpiles with geotextile fabric to provide further protection against wind and water erosion.
- Install sediment barriers on graded or otherwise disturbed slopes as needed to prevent sediment from leaving the project site and entering nearby surface waters.
- Use and store hazardous materials, such as vehicle fuels and lubricants, in designated staging areas located away from surface waters. Implement a spill prevention and control plan that specifies measures that will be used to prevent, control, and clean up hazardous material spills.
- Install plant materials to stabilize cut and fill slopes and other disturbed areas once construction is complete. Plant materials may include an erosion control seed mixture or shrub and tree container stock. Temporary structural BMPs, such as sediment barriers, erosion control blankets, mulch, and mulch tackifier, may be installed as needed to stabilize disturbed areas until vegetation becomes established.
- Implementation of the BMPs specified in the erosion control plan and SWPPP would substantially reduce the potential for accelerated erosion and sedimentation to occur as a result of construction-related ground and vegetation disturbance.

7. OTHER PERMITS/AGREEMENTS/ETC

a) U.S. Army Corps of Engineers Permit
Indicate the type of ACOE permit *(check one)*
Nationwide Permit No(s)______ Individual Permit No*(s)*:______ Regional Permit No*(s)*:______

Have you notified ACOE of project? ____Corps Project______

Have you reviewed the General Conditions for your ACOE permit? _Corps Project__

Have you attached a copy of the application/notification to ACOE? _See Section 404(b) (1) Evaluation in Environmental Assessment

b) California Department of Fish and Game Lake or Streambed Alteration Agreement: Not Applicable. Federal Project.

Date of Application:_____________

Have you attached a copy of the application?

Has the Agreement been issued? _____ if so, list Agreement number:______

8. CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

a) Indicate the type of CEQA Document required for project and Lead Agency:

Categorical Exemption _yes_ Negative Declaration ____ Environmental Impact Report _____ CEQA document, Mitigated Negative Declaration, and Notice of Determination may not be filed. Reclamation Board, and DWR may elect to use emergency declaration.

Has the document been certified/approved, or has a Notice of Exemption been filed?

__yes__

If yes date of approval/filing _11-28-06____ If no, expected approval/filing date:

____

Lead Agency ____Department of Water Resources – California Reclamation Board____
Submit final or draft copy if available*

b) Threatened or Endangered Species impacted by this project *(list potential)*: Eleven special-status wildlife species occur or have the potential to occur in the project area. These species include: giant garter snake (*Thamnophis couchi gigas*), valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), Cooper's hawk (*Accipiter cooperii*), Swainson's hawk (*Buteo swainsoni*), white-tailed kite (*Elanus leucurus*), Central Valley steelhead (*Oncorhynchus mykiss*), Sacramento River winter-run Chinook salmon (O. tshawytscha), Central Valley spring-run Chinook salmon (*O. tshawytscha*), delta smelt (*Hypomesus transpacificus*), green sturgeon (*Acipenser medirostris*), and late fall/fall-run Chinook salmon (*O. tshawytscha*).

9. PAST/FUTURE PROPOSALS BY THE APPLICANT

Briefly list/describe any projects carried out in the last 5 years or planned for implementation in the next 5 years that are in any way related to the proposed activity or may impact the same receiving body of water. Include the estimated adverse impacts from the past or future projects. Current authorization of the Sacramento River Bank Protection Project includes 28,000 linear feet throughout the Sacramento River Flood Control Project. This program is on-going and will incorporate similar measures for bank protection as described in the EA.

10. CERTIFICATION

"I certify under penalty of law that this document, including all attachments and supplemental information, were prepared under my direction and supervision in accordance with a system designed to assure that qualified personnel property gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

Print Name: _E. Scott Clark___ Title: Chief, Planning Division, USACE, Sacramento District_

Signature:_________________________________
Date:__________________________

Appendix E

Section 404(b) (1) Evaluation

Appendix E. Section 404(b) (1) Evaluation

Levee Repair of 14 Winter 2006 Priority Sites

Sacramento River Bank Protection Project, Sacramento California

I. Project Description

The U.S. Army Corps of Engineers (Corps) and the State of California Reclamation Board (Reclamation Board) propose to implement bank protection measures to prevent ongoing streambank erosion at 14 critically eroding sites along the Sacramento River and Steamboat Slough. Eleven of the 14 sites are along the Sacramento River at River Mile (RM) 16.9L, 33.0R, 33.3R, 43.7R, 44.7R, 47.0L, 47.9R, 48.2R, 62.5R, 68.9L, and 78.0L. Three critically eroding sites are along Steamboat Slough at RM 19.0R, 19.4R, and 22.7R. The 14 sites are located in Yolo, Sacramento, Sutter, and Solano counties. These 14 sites are among 24 critical erosion sites in Governor Schwarzenegger's February 24, 2006 Declaration of State of Emergency of California Levee System, and March 7, 2006 Executive Order S-01-06. Erosion into the banks at these sites requires immediate work to prevent levee failure.

a. <u>Location</u>

The project area extends along the Sacramento River from RM 16.9 to RM 78.0. The 14 erosion sites are located from the most downstream site near the town of Isleton in Sacramento County, to the most upstream site north east of the town of Woodland also in Sacramento County. The RM locations and lengths of the 14 sites are listed (Table 1). A location and vicinity map for the 14 sites is provided in Figure 1 of the EA, and cross-sectional and plan view maps for each site are provided in Figures 2–28 of the EA.

Table 1. Erosion site river mile locations, counties, and lengths.

Erosion site	Water body	County	Length of erosion (feet)
RM 16.9L	Sacramento River	Sacramento	210
RM 19.0R	Steamboat Slough	Solano	552
RM 19.4R	Steamboat Slough	Solano	272
RM 22.7R	Steamboat Slough	Sacramento	222
RM 33.0R	Sacramento River	Yolo	326
RM 33.3R	Sacramento River	Yolo	235
RM 43.7R	Sacramento River	Yolo	1,090
RM 44.7R	Sacramento River	Yolo	1,585
RM 47.0L	Sacramento River	Sacramento	1,156
RM 47.9R	Sacramento River	Yolo	1,031
RM 48.2R	Sacramento River	Yolo	1,039
RM 62.5R	Sacramento River	Yolo	255
RM 68.9L	Sacramento River	Sacramento	786
RM 78.0L	Sacramento River	Sutter	1,058
Total			**9,817**

b. General Description

The U.S. Army Corps of Engineers (Corps) and the State of California Reclamation Board (Reclamation Board) propose to implement bank protection measures to prevent ongoing streambank erosion at 14 critically eroding sites along the Sacramento River and Steamboat Slough. Eleven of the 14 sites are along the Sacramento River at River Mile (RM) 16.9L, 33.0R, 33.3R, 43.7R, 44.7R, 47.0L, 47.9R, 48.2R, 62.5R, 68.9L, and 78.0L. Three critically eroding sites are along Steamboat Slough at RM 19.0R, 19.4R, and 22.7R. The 14 sites are located in Yolo, Sacramento, Sutter, and Solano counties. These 14 sites are among 24 critical erosion sites in Governor Schwarzenegger's February 24, 2006 Declaration of State of Emergency of California Levee System, and March 7, 2006 Executive Order S-01-06. Erosion into the banks at these sites requires immediate work to prevent levee failure.

The proposed bank protection measures would include: (1) protecting the toe and upper slopes of the bank with riprap; (2) establishing a berm around the mean summer water level (MSWL) to provide aquatic habitat during lower and higher river stages in winter and spring; (3) placing instream wood material (IWM) for aquatic habitat; and (4) planting pole and container plantings to stabilize the bank and provide riparian and shaded riverine aquatic habitat.

c. Background

Over the years, at the 14 sites' river banks, continued erosion has threatened the stability of the levees in these areas. In downstream locations, the erosion appears to be due to wave run-up from tidal and wind action, as well as some recreational boat traffic during the summer months. The Corps, Reclamation Board, and their consultants have made several field assessments of these sites over the last few years. The levee berm has almost completely eroded away along the waterline at most sites, threatening the integrity of the upper banks. Recent bathymetric surveys conducted in April 2006 indicate the development of scour holes in the river bed near the toes of the levees in many locations. To fill those scour holes, the project design includes rock fill of the holes with riprap toe protection. Riprap and soil berms will also be placed on the upper banks of the levees to protect these areas from further erosion, while maintaining existing vegetation as much as possible.

d. Authority and Purpose

This project is a component of the Sacramento River Bank Protection Project (SRBPP), which was authorized by Congress under the Flood Control Act of 1960 (Public Law 86-645). Congress authorized the SRBPP in accordance with the recommendations of the Chief of Engineers in Senate Document No. 103, 86th Congress, Second Session, entitled "Sacramento River Flood Control Project, California," dated May 26, 1960. Authorization for environmental features associated with the project was provided in the Water Resources Development Act (WRDA) of 1990. The SRBPP is a State-federal partnership between the Corps and Reclamation Board.

Additionally, as noted above, the 14 sites within this proposed Project are among the 24 newly identified critical levee erosion sites that recently prompted the Army Corps to issue a Declaration of Emergency. The Governor of California and the Army Corps have both determined that emergency repairs are needed to prevent a catastrophic levee failure.

This Environmental Assessment (EA): (1) describes the existing environmental resources in the project area; (2) evaluates the project alternatives' environmental effects on those resources; and (3) if the effects are significant, determines and describes actions that may be taken to mitigate and reduce environmental effects such that they become not significant. The purpose of this EA is to fulfill the permitting requirements of the state and federal agencies that are implementing the project.

The California Governor's Office and the US Army Corps of Engineers have declared states of emergency for the levee repair work, and this project qualifies as an emergency exemption under CEQA and NEPA. This project qualifies as a statutory exemption under CEQA (Section 15269);

> (b) emergency repairs to publicly or privately owned service facilities necessary to maintain service essential to the public health, safety or welfare, and;

> (c) Specific actions necessary to prevent or mitigate an emergency. This does not include long-term projects undertaken for the purpose of preventing or mitigating a situation that has a low probability of occurrence in the short-term.

As an emergency exemption under NEPA, stated in 33 CFR 230.8,

> In responding to emergency situations to prevent or reduce imminent risk of life, health, property, or severe economic losses, district commanders may proceed without the specific documentation and procedural requirements of other sections of this regulation. District commanders shall consider the probable environmental consequences in determining appropriate emergency actions and when requesting approval to proceed on emergency actions, will describe proposed NEPA documentation or reasons for exclusion from documentation. NEPA documentation should be accomplished prior to initiation of emergency work if time constraints render this practicable. Such documentation may also be accomplished after the completion of emergency work, if appropriate. Emergency actions include Flood Control and Coastal Emergencies Activities pursuant to Pub. L. 84-99, as amended, and projects constructed under sections 3 of the River and Harbor Act of 1945 or 14 of the Flood Control Act of 1946 of the Continuing Authorities Program. When possible, emergency actions considered major in scope with potentially significant environmental impacts shall be referred through the division commanders to HQUSACE (CECW-RE) for consultation with CEQ about NEPA arrangements. The Declaration of Emergency enables the Army Corps of Engineers to begin repairs by mid-December while concurrently completing the environmental assessments and mitigation plans.

In addition, the EA will serve as a biological assessment to be provided to the National Marine Fisheries Service (NMFS) and the US Fish and Wildlife Service (USFWS) for the Section 7 Endangered Species Act (ESA) consultation, including evaluation of effects of the project on listed and sensitive species, critical habitat, and essential fish habitat. A programmatic biological assessment is currently being prepared for the Sacramento River Bank Protection Project, but consultation will not be completed prior to the need to implement the proposed project.

e. <u>General Description and Quantity of Dredged or Fill Material</u>

(1) General Characteristics of Material

Bank protection measures will be implemented at each of the 14 sites and, in total, the overall project would generally consist of: (1) reinforcement of the bank toe with a total of 9,800 lineal feet (LF) of riprap covering a plan view area of 8.5 acres; (2) placement of a mixture of riprap and soil (mixture of sand and silt suitable for plant growth) on upper banks and tops of the lower banks’ riprap, to create riparian benches above the MSWL, covering a total area 13.4 acres; (3) planting the benches and upper banks with vegetation to provide bank stabilization and riparian habitat. Tidal variations range from ± 2–3 ft for the sites nearest the Delta, with variations of ± 0–1 ft at sites further upstream.

Estimates of project areas (acreages) above and below the median summer water surface elevation (WSEL) affected by project construction (i.e., the project footprint), and of required material quantities are listed by site (Tables 2 and 3). The total surface area of the construction footprint is estimated to be 21.8 acres, resulting in the conversion of approximately 7.3 acres of existing open water habitat into riparian habitats, with an additional conversion of 0.7 acres of open water habitat into wetland habitat. In total, Phase 1 construction includes approximately 117,000 cubic yards of riprap that would be placed along the lower banks to reinforce the levee toe at the 14 sites. During Phase 2, approximately 97,000 cubic yards of additional riprap and soil would be used to build up the benches and upper banks at the project sites. The quantities of riprap, soil and IWM to be placed may vary slightly from the above estimates due to conditions encountered at the site during construction as well as Fall/Winter 2006/07 flow conditions.

Table 2. Acreages* for the Project construction footprint at each site.

Site	Water body	Total site area (acres)	Existing area above water (acres)	Existing area below water (acres)	Post-Project area above water (acres)	Post-Project area below water (acres)
RM 16.9L	Sacramento River	0.4	0.15	0.31	0.15	0.26
RM 19.0R	Steamboat Slough	0.9	0.63	0.44	0.63	0.25
RM 19.4R	Steamboat Slough	0.4	0.28	0.23	0.28	0.14
RM 22.7R	Steamboat Slough	0.4	0.20	0.30	0.20	0.23
RM 33.0R	Sacramento River	0.9	0.42	0.71	0.42	0.46
RM 33.3R	Sacramento River	0.7	0.38	0.51	0.38	0.32
RM 43.7R	Sacramento River	2.5	1.53	1.75	1.53	0.98
RM 44.7R	Sacramento River	3.6	2.62	2.19	2.62	1.02
RM 47.0L	Sacramento River	2.0	1.22	1.91	1.22	0.77
RM 47.9R	Sacramento River	3.1	1.14	2.42	1.14	1.94
RM 48.2R	Sacramento River	2.4	1.43	1.48	1.43	0.96
RM 62.5R	Sacramento River	0.6	0.35	0.53	0.35	0.27
RM 68.9L	Sacramento River	1.9	1.48	1.36	1.48	0.40
RM 78.0L	Sacramento River	1.9	1.51	1.56	1.51	0.44
Total		21.8	13.36	15.70	13.36	8.45

* Acreages were estimated as projected in plan view.

Table 3. Material quantities for Project sites.

Site	IWM removed (lineal feet)[1]	IWM Placed above MSWL[2]	Riprap placed (cubic yards)[3]	Riprap and soil mixture placed (cubic yards)[3]
RM 16.9L	30		2,722	1,750
RM 19.0R	98		2,044	5,111
RM 19.4R	12		967	1,612
RM 22.7R	35		1,842	2,138
RM 33.0R	25	293	7,848	2,656
RM 33.3R	15	212	5,361	2,559
RM 43.7R	65	981	14,533	14,533
RM 44.7R	243	1,427	19,372	17,846
RM 47.0L	72	1,040	8,734	5,823
RM 47.9R	140	928	13,365	9,317
RM 48.2R	107	935	13,930	8,774
RM 62.5R	40	230	5,138	2,361
RM 68.9L	50	707	10,189	10,946
RM 78.0L	20	952	10,698	11,756
Total	**952**	**7,705**	**116,744**	**97,181**

1. Existing length of IWM estimated from % shoreline cover during visual bank-line surveys in November 2006.
2. Length of anchored IWM to be placed estimated at 90% of site length.
3. Volume of riprap (Phase 1) and riprap/soil mixture (Phase 2) estimated from site cross-sections.

For riparian reestablishment, riparian benches will be constructed to flood at river stages corresponding to high tide (where tidally influenced) at average winter/spring flows. Container plants and pole cuttings would be installed along the lower bank, bench and upper bank with the long-term goal of providing riparian and shaded riverine aquatic (SRA) cover habitat as defined by USFWS (Fris and DeHaven 1993). These areas would be seeded and covered with mulch to prevent soil loss during the first high water which would likely occur before plantings have become established.

Ten of the 14 sites (Sacramento River Sites RM 33.0R, 33.3R, 43.7R, 44.7R, 47.0L, 47.9R, 48.2R, 62.5R, 68.9L, 78.0L) will have anchored woody material placed on top of the riparian benches. Individual pieces will be anchored either parallel to the bank or at an oblique angle to the river flow. Woody materials would: (1) be between 23 and 35 feet long; (2) maintain a crown branch structure that is approximately 6–8 feet wide; and (3) retain limbs and root wads (to the extent feasible) for maximum habitat value.

In addition to the riparian benches, planted wetland benches will be constructed at five sites, including two sites in the Sacramento River (Sites RM 16.9L and 43.7R) as well as three sites in Steamboat Slough (Sites RM 198.0R, 19.4R and 22.7R). The wetland benches will be constructed to remain inundated at river stages corresponding to low tide at average summer/fall flows.

(2) Source of Material

Fill materials including rock revetment may be hauled from a quarry in San Rafael, California, which is within approximately 100 miles or less of each of the 14 sites. Other sites for rock revetment exist and the source would be determined by the selected contractor.

f. <u>Description of the Proposed Discharge Site(s)</u>

(1) Location (map)

The location of the discharge sites would be the Sacramento River and Steamboat Slough at the 14 project sites, as summarized in Table 1. A location and vicinity map for the sites is provided in Figure 1 of the EA, and detailed cross-sectional and plan view maps for each site are provided in Figures 2–28 of the EA.

(2) Size (acres)

The total size of the potential fill/impacted area would be almost 7.87 acres of open water.

(3) Type of Site (confined, unconfined, open water)

The fill needed for the bank protection construction would take place in open water areas.

(4) Type(s) of Habitat

In total, four land cover types exist at the 14 sites: riparian forest, riparian scrub/shrub, ruderal herbaceous vegetation, and open water (i.e., the Sacramento River or Steamboat Slough) (Table 4). Each of these cover types is described in more detail in Section 4.1.1 of the EA. Fill in the open water area would occur in a glide habitat.

Table 4. Land types and associated area (acres and percent) in the Project construction footprint (i.e., spatial extent of Project).

Site	Acreage by land cover type (% of area above water)				Total above water	Open water
	Riparian forest	Riparian scrub/ shrub	Ruderal herbaceous	Sub total		
16.9L	0.05 (48%)	0.05 (48%)	0.00 (3%)	0.10	0.41	0.31
19.0R	0.13 (28%)	0.18 (39%)	0.15 (33%)	0.46	0.69	0.44
19.4R	0.06 (34%)	0.10 (52%)	0.03 (14%)	0.18	0.63	0.23
22.7R	0.06 (42%)	0.02 (12%)	0.07 (46%)	0.15	0.45	0.30
33.0R	0.02 (14%)	0.09 (53%)	0.03 (15%)	0.14	0.68	0.71
33.3R	0.11 (60%)	0.03 (16%)	0.04 (21%)	0.18	0.90	0.51
43.7R	0.45 (63%)	0.01 (1%)	0.11 (16%)	0.58	2.48	1.75
44.7R	1.08 (75%)	0.13 (9%)	0.21 (14%)	1.41	3.63	2.19
47.0L	0.00 (12%)	0.00 (0%)	0.00 (0%)	0.00	2.45	1.91
47.9R	0.66 (97%)	0.02 (3%)	0.00 (0%)	0.68	2.59	2.42
48.2R	0.86 (95%)	0.00 (0%)	0.05 (5%)	0.90	2.38	1.48
62.5R	0.05 (74%)	0.02 (23%)	0.00 (0%)	0.07	0.60	0.53
68.9L	0.03 (13%)	0.01 (4%)	0.18 (83%)	0.21	1.57	1.36
78.0L	0.18 (90%)	0.02 (10%)	0.00 (0%)	0.20	1.75	1.56
Total	**3.74 (67.87%)**	**0.66 (12.05%)**	**0.86 (15.65%)**	**5.27**	**21.22**	**15.70**

A total of 104 elderberry shrubs in eight main clumps were located at four sites: RM 44.7R, 47.0L, 47.9R, and 48.2R. The locations of elderberry shrubs are provided in Appendix C-1 of the EA. The results of elderberry surveys conducted in November 2006 are summarized in Appendix C-2 of the EA. At Site RM 44.7R, a total of 87 shrubs were identified, of which 72 were within 100 ft of the Project footprint, though none were inside of the footprint itself. At Site RM 47.0L, a total of eight shrubs was identified, all of which were within 100 ft of the Project footprint, though none were inside of the footprint itself. At Site RM 47.9R, a total of three shrubs was identified, all of which were located within the Project footprint. At Site RM 48.2R, a total of six shrubs was identified, one of which had a potential exit hole. Four of the six shrubs observed were located inside of the Project footprint and the other two were within 100 ft of the Project footprint.

The season to survey valley elderberry longhorn beetle and exit holes is March-June, consequently additional surveys will need to be conducted at this time to determine species presence or absence from these sites.

During construction activities, 166 elderberry stems ≥ 1 inch in diameter could be affected by levee restoration activities at Sites RM 44.7R, 47.0L, 47.9R, and 48.2R. All shrubs associated with these stems occur within 100 feet of Project footprint, with the exception of 15 shrubs at Site RM 44.7R. The shrubs located outside of the 100 ft buffer can be avoided by a minimum of 20 feet. For all other shrubs, it is expected that fencing and other protection measures as outlined in the *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (USFWS 1999) would be sufficient to prevent any impacts from occurring to any of these shrubs.

At Site RM 48.2R there are four shrubs and at site RM 47.9R there are three shrubs that are within the Project footprint and therefore have the greatest potential to be damaged. These shrubs would be avoided if possible, but construction equipment and personnel could accidentally damage limbs or root structures when working in close proximity. In addition, it is possible that one or more elderberry shrubs would need to be removed to facilitate the placement of bank protection materials. If elderberry shrubs are damaged or need to be transplanted, mitigation would be implemented as described in the *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (USFWS 1999).

No insecticides, herbicides, fertilizers, or other chemicals that might harm the beetle or its host plant will be used in the buffer areas, or within 100 feet of any elderberry plant with one or more stems measuring 1.0 inch or greater in diameter at ground level. Additional mitigation measures for elderberry are discussed in Section 4.3.4.1 of the EA.

(5) Timing and Duration of Discharge

The construction will occur in two phases (Phases 1 and 2). Phase 1 construction will occur during Fall/Winter 2006/07; all Phase 1 work will be from the waterside. During Phase 2, which will occur during Spring and Summer 2007, construction at four sites will occur from the landside (Sites RM 47.0L, 62.5R, 68.9L, and 78.0L), with work at two other sites (RM 47.9R and 48.2R) from either water- or landside. The Phase 2 work at the remaining sites on the Sacramento River (Sites RM 16.9L, 33.0R, 33.3R, 43.7R, and 44.7R) and all three sites on Steamboat Slough (Sites RM 19.0R, 19.4R, and 22.7R) will be from the waterside.

The Phase 1 construction window is from November 13, 2006 to June1, 2007. The US Fish and Wildlife Service has confirmed that work could begin immediately and that "the Section 7 consultation will be expedited and treated as an emergency consultation" (US Fish and Wildlife Service 2006). Phase 2 will commence June 1, 2007 through November 30, 2007.

Placement of riprap, the rock/soil mixture, and IWM would be completed during one construction season. Vegetation would be installed and maintained during that same construction season and then maintained for an additional 3 years. Maintenance activities may occur year-round in the overbank and dry areas, but would avoid any elderberry shrubs by 100 feet or another distance coordinated with USFWS. In coordination with Federal and State resource agencies, any in-water work needed for maintenance would be conducted during appropriate time periods to avoid adverse effects on fish. The current acceptable in-water work "window" for listed salmonids is July 1 to October 30 in any year.

h. <u>Description of Disposal Method (hydraulic, drag line, etc.)</u>

At all 14 erosion sites, fill work (Phase 1 bank protection activities) will be conducted from cranes mounted on barges in the Sacramento River or Steamboat Slough, with the crane (boom) systems mechanically placing the rock along the shore and beneath the water line. Waterside construction will minimize noise and traffic disturbances, and effects on existing vegetation. The contractor may choose to use excavators, loaders, and other construction equipment once the riprap has reached the MSWL.

The contractor will use adjacent landside areas for staging of vehicles, plant materials, and other associated construction equipment, as necessary. Protective fencing will be installed to prevent vehicles from getting too close to the waterside edge of the existing bank materials. The exact locations of staging areas have not been determined, but agricultural properties that could accommodate staging areas are available at all sites.

II. Factual Determinations (Section 230.11)

a. <u>Physical Substrate Determinations (consider items in Section 230.11(a) and 230.20 Substrate)</u>

(1) Substrate Elevation and Slope

Elevation of the 14 sites varies from minus 23 ft (NGVD) at Site RM 33.0R to 37 ft at Site RM 78.0L (Table 5). The range of existing slopes at each site is summarized in Table 5, and varies across the 14 sites from 1.9H:1V to 7.8H:1V.

Table 5. Range of existing site elevations (from typical cross-sections) and slopes at each site. Elevations are relative to NGVD 29.

Site	Approximate Min. Elevation (ft)	Summer Median Water Surface Elevation[1] (ft)	Approximate Max. Elevation (ft)	Existing Slope Range[2] (H:V)
RM 16.9L	-14	2.1	15	4.4 – 6.8
RM 19.0R	-3	2.1	21	4.6 – 6.9
RM 19.4R	-5	2.1	18	3.2 – 4.0

Site	Approximate Min. Elevation (ft)	Summer Median Water Surface Elevation[1] (ft)	Approximate Max. Elevation (ft)	Existing Slope Range[2] (H:V)
RM 22.7R	-12	2.1	20	2.3 – 3.0
RM 33.0R	-23	2.6	21	2.6 – 2.8
RM 33.3R	-22	2.6	24	1.9 – 2.0
RM 43.7R	-10	4.1	25	2.1
RM 44.7R	-10	4.3	32	2.5
RM 47.0L	-4	4.6	21	6.3 – 7.8
RM 47.9R	-10	4.8	18	2.8 – 3.1
RM 48.2R	-8	4.8	25	2.7 – 2.9
RM 62.5R	-13	7.0	26	2.6 – 4.4
RM 68.9L	0	8.0	32	3.4 – 3.6
RM 78.0L	4	11.6	37	2.4 – 2.5

[1] Based on values presented in Table 4-18 (Section 4.4.2.1) of the EA.
[2] Based on seasonal bank slope values presented in Appendix I of the EA.

(2) Sediment Type

Natural bank soils at each site are primarily river deposits, which include silts, sands, and gravel. Sites RM 16.9L, 33.0R, 33.3R, 47.0L, and 47.9R also contain some existing, isolated rock revetment material typically 12–20 inches in diameter located in areas away from the erosion sites considered under this project.

(3) Dredged/ Fill Material Movement

The fill material needed for the bank protection construction is not expected to move either during construction or after construction is completed. Construction personnel would use existing roads or would access the site by barge from the river. Some fill may be used to access the immediate construction site from the levee road; however, this material would be incorporated into the final site design. For example, the contractor may elect to access the site from constructed berms.

(4) Physical Effects on Benthos (burial, changes in sediment type, etc.)

All of the fill associated with the construction takes place in submerged, open water areas. It is expected that the benthos of the river bottom areas within the footprint of bank protection would be completely eliminated by the fill activity.

(5) Other Effects

The installation of the fill material to complete bank protection activities would, over the long-term, reduce sediment input into the Sacramento River and Steamboat Slough.

(6) Actions Taken to Minimize Impacts (Subpart H)

Fill material would only be placed where it is needed for bank protection. During construction, disturbance outside of the project area would be kept to a minimum. The Corps would implement a Storm Water Pollution Prevention Plan before and during construction to minimize turbidity generating activities. The Corps will monitor turbidity and settleable solids to avoid violation of basin standards. The contractor would be required to develop and implement a hazardous materials management plan prior to initiation of construction. The plan would include best management practices to (1) reduce the likelihood of spills of toxic chemicals and other hazardous materials during construction, (2) describe a specific protocol for the proper handling and disposal of materials and contingency procedures to follow in the event of an accidental spill, and (3) describe a specific protocol for the proper handling and disposal of materials should materials be encountered during construction.

b. Water Circulation, Fluctuation, and Salinity Determinations

(1) Water (refer to section 230.11(b), 230.22 <u>Water</u>, and 230.25 <u>Salinity Gradients</u>; test specified in subpart G may be required). Consider effects on:

(a) Salinity

The fill would occur in areas of permanent water in the Sacramento River and Steamboat Slough. When these areas receive water, it is from rain or flood events. All waters affected are freshwater and therefore filling these areas would not adversely affect salinity.

(b) Water Chemistry (pH, etc.)

The fill areas are in areas of permanent water. Materials would be tested for pH prior to placement so as not to affect water chemistry.

(c) Clarity

Fill would occur in areas of permanent water. The Corps would adhere to turbidity and water chemistry requirements associated with the Corps 401 water quality permit (to be issued).

(d) Color

The proposed project is expected to affect color only during fill activities.

(e) Odor

The proposed project is not expected to affect odor.

(f) Taste

The proposed project is not expected to affect taste.

(g) Dissolved Gas Level

Fill would occur in areas of permanent water. During filling the Corps would adhere to turbidity and water chemistry requirements associated with the Corps 401 water quality permit (to be issued).

(h) Nutrients

None of the proposed project components would adversely affect nutrients in the water.

(i) Eutrophication

Fill would occur in areas of permanent water. During filling, the Corps would adhere to turbidity and water chemistry requirements associated with the Corps 401 water quality permit.

(j) Others as Appropriate

The proposed project is not expected to affect other water characteristics.

(2) Current Patterns and Circulation (consider items in Section 230.11(b), and 230.23), <u>Current Flow and Water Circulation</u>

(a) Current Patterns and Flow
Although some changes to the shoreline contour are anticipated due to the proposed fill, the project is not expected to affect general current and flow patterns.

(b) Velocity

The velocities of stormwater and the velocities during flood events are not expected to change with the project.

(c) Stratification

The proposed project is not expected to significantly affect stratification.

(d) Hydrologic Regime

The hydrologic regime of the stormwater runoff is not expected to change with the proposed project.

(3) Normal Water level Fluctuations (tides, river stage, etc.) (consider items in Sections 230.11(b) and 230.24)

Although the proposed project may reduce the section width by 5–20 feet in the construction area, normal water fluctuations would not be affected. The project would not affect stage elevations.

(4) Salinity Gradients (consider items in section 230.11(b) and 230.25)

Since the fill areas receive freshwater stormwater runoff, salinity gradients would not be affected.

(5) Actions That Will Be Taken to Minimize Impacts (refer to Subpart H)

Effects on pattern or flow of stormwater runoff are not expected to be significant. Therefore, no additional minimization measures are needed that are not already defined in Subpart H.

e. <u>Suspended Particulate/ Turbidity Determinations</u>

(1) Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Site (consider items in section 230.11(c) and 230.21)

Temporary changes in particulates and turbidity would occur during construction. There would not be significant long-term changes in suspended particulates and turbidity. It is anticipated that turbidity would increase by 5 NTU's above ambient levels during construction activities. It is anticipated that an increase of < 20% above ambient levels would be acceptable to the RWQCB based on previous bank protection projects in the area.

For water quality mitigation, and as detailed in the SWPPP, the Corps' contractor would conduct water quality tests specifically for increases in turbidity and sedimentation caused by construction activities as described below:

- Sampling location – Water samples for determining background levels at the time of construction shall be collected in the Sacramento River at upstream locations within the general vicinity of the construction site. Upstream testing to establish background levels shall be performed at least once a day when construction activity is in progress. Water samples for determining down-current turbidity and settleable solid levels shall be collected in the Sacramento River at a point 5 feet out from the shoreline and 300 feet down current of each construction site.

- Turbidity – During working hours, the construction activity shall not cause the turbidity in the Sacramento River down-current from each construction site to exceed:
    - where natural turbidity is between 0 and 5 Nephelometric Turbidity Units (NTUs), increases shall not exceed 1 NTU above ambient levels;

- where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20 percent of ambient levels;
- where natural turbidity is between 50 and 100 NTUs, increases shall not exceed 10 NTUs above ambient levels;
- where natural turbidity is greater than 100 NTUs, increases shall not exceed 10 percent of ambient levels.

These limits would be eased during in-water working periods to allow a turbidity increase of 15 NTU over background turbidity as measured in surface waters 300 feet downstream from the working area. In determining compliance with the above limits, appropriate averaging periods may be applied provided that beneficial uses would be fully protected.

- Settleable Solids – Settleable solids shall be determined by APHA (1998) Method 2540F. During working hours, the construction activity shall not cause the settleable solids in the Sacramento River down-current from each construction site to exceed 0.1 mL/L after one hour settling.

If turbidity or settleable solids measurements exceed the values listed above, the contractor would either slow construction or stop until compliance with the regulation is achieved. Therefore, this impact would be less than significant and no further mitigation is required.

(2) Effects (degree and duration) on Chemical and Physical Properties of the water Column (consider environmental values in Section 230.21, as appropriate)

(a) Light Penetration

There would not be adverse effects on light penetration due to the project.

(b) Dissolved Oxygen

There would be no adverse effects on dissolved oxygen due to the project.

(c) Toxic Metals and Organics

Due to the inertness of the fill materials, there would be no exchange of constituents between the fill and aquatic systems. Measures described in the SWPPP, prepared to RWQCB guidelines, and EA would minimize the potential for contaminants to be introduced into the fill areas.

The contractor would be required to develop and implement a hazardous materials management plan prior to initiation of construction. The plan would include best management practices to: (1) reduce the likelihood of spills of toxic chemicals and other hazardous materials during construction, (2) describe a specific protocol for the proper handling and disposal of materials and contingency procedures to follow in the event of an accidental spill, and (3) describe a specific protocol for the proper handling and disposal of materials should materials be encountered during construction. Any spills of hazardous materials within the Sacramento River shall be cleaned up immediately with notifications provided to the CVRWQCB, NMFS, and USFWS.

(d) Pathogens

The proposed project would not introduce pathogens to the aquatic community.

(e) Aesthetics

There would be temporary aesthetic effects during construction (construction equipment and general disturbance), but the effects are not considered significant, and there will be a net long-term increase in native vegetation and IWM than the preconstruction condition.

A crane on top of a barge or on top of a levee would be visible to residents and visitors within the surrounding areas. Motorists, boaters, pedestrians, and bicyclists using the levee crown would be able to see the construction equipment. The equipment would be visible for approximately 120 days. The presence of construction equipment would degrade the visual quality of scenic vistas from the levee top and river to that of lower vividness, intactness and unity. However, because these effects are temporary (i.e., only for the duration of construction), they are considered to be less than significant.

Visual effects from the placement of riprap and rock onto the bank would be offset by the installation of IWM, soil fill, and tree plantings. These features would successfully establish and cover the riverbank within a 2-year period.

(f) Others as Appropriate

There would be no other significant adverse effects on the chemical and physical properties of the water column.

(3) Effects on Biota (consider environmental values in Section 230.21, as appropriate)

(a) Primary Production, Photosynthesis

The project may temporarily affect primary production and photosynthesis in those areas filled, and in downstream areas affected by temporary project-related increases in suspended sediment, turbidity, or sediment deposition. However, the effect would be temporary and less than significant.

(b) Suspension/ Filter Feeders

The project may temporarily affect suspension and filter feeders in those areas filled, and in downstream areas affected by temporary project-related increases in suspended sediment or turbidity. However, the effect would be temporary and less than significant for the area.

(c) Sight Feeders

The project would temporarily affect sight feeders in those areas filled, and in downstream areas affected by temporary project-related increases in suspended sediment or turbidity. However, the effect would be temporary and less than significant for the area.

(4) Actions Taken to Minimize Impacts (Subpart H)

Effects to the aquatic biota would be temporary and not significant at the project sites and in the areas downstream. Therefore, no additional measures to minimize effects are needed for fill occurring there.

d. Contaminant Determinations (consider items in Section 230.11(d))

The proposed project would not add contaminants to any nearby body of water. Best management practices to reduce the potential of accidental spills during construction are included in the EA. The rock and soil fill material for the sites would not be contaminated and would be tested for contaminants prior to placement.

e. Aquatic Ecosystem and Organism Determinations (use evaluation and testing Procedures in Subpart G, as appropriate)

(1) Effects on Plankton

The project may temporarily affect plankton in those areas filled, and in downstream areas affected by temporary project-related increases in suspended sediment or turbidity. However, the effect would be temporary and less than significant for the area, and no additional measures to minimize effects are needed for fill occurring in the area.

(2) Effects on Benthos

The project may temporarily affect benthos in those areas filled, and in downstream areas affected by temporary project-related increases in suspended sediment, turbidity, or sediment deposition. However, the effect would be temporary and less than significant, and no additional measures to minimize effects are needed for fill occurring in the area.

(3) Effects on Nekton

The project may temporarily affect plankton in those areas filled, and in downstream areas affected by temporary project-related increases in suspended sediment or turbidity. However, the effect would be temporary and less than significant for the area, and no additional measures to minimize effects are needed for fill occurring in the area.

(4) Effects on Aquatic Food Web (refer to Section 230.31)

Effects on the aquatic food web, or the plankton, benthic, and nekton communities, would be temporary and less than significant.

(5) Effects on Special Aquatic Sites (discuss only those found in project area or disposal site)

(a) Sanctuaries and Refuges (refer to section 230.40)

There would be no adverse effects to sanctuaries or refuges with the proposed project.

(b) Wetlands (refer to section 230.41)

No wetlands would be filled; therefore, there would be no adverse effects on wetlands with the proposed project.

(c) Mud Flats (refer to Section 230.42)

There would be no adverse effects on mud flats with the proposed project.

(d) Vegetated Shallows (refer to Section 230.43)

There would be no adverse effects on vegetated shallows with the proposed project. The project would create 0.67 acres total of vegetated shallows at sites RM 16.9L, 19.0R, 19.4R, 22.7R, and 43.7R.

(e) Coral Reefs (refer to Section 230.44)

There would be no adverse effects on coral reefs with the proposed project.

(f) Riffle and Pool Complexes (refer to section 230.45)

There would be no adverse effects to riffle and pool complexes.

(6) Threatened and Endangered Species (refer to Section 230.30)

The proposed action at the erosion sites would affect the following special-status species: valley elderberry longhorn beetle, western pond turtle, giant garter snake, Swainson's hawk, Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley fall-/late fall-run Chinook salmon, Central Valley steelhead, delta smelt, green sturgeon, and Sacramento splittail. Project effects also include alteration of Essential Fish Habitat of Chinook salmon (all runs), and the designated critical habitat of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead, and delta smelt.

Short-term construction-related effects may include localized disturbance or displacement of these special-status species due to noise, vibration, suspended sediment, and turbidity generated during in-water construction activities. The potential also exists for injury or mortality to the special-status aquatic species that may not be able to readily move away from channel or nearshore areas directly affected by construction activities.

Long-term impacts due to loss of habitat will be mitigated through planting of native riparian vegetation and placement of IWM.

(7) Other Wildlife (refer to Section 230.32)

Wildlife effects associated with the construction are expected to be temporary. Generally, wildlife species that use the areas around the project area are mobile species that would leave the area during construction and return when construction is completed. Therefore, the proposed project would not have any significant adverse effects on wildlife over what was described in the EA.

(8) Actions to Minimize Impacts (refer to Subpart H)

In consideration of the above information, the proposed action is likely to result in take but is not likely to result in jeopardy to these species as long as the applicable conservation and mitigation measures are adhered to. The conclusion of non-jeopardy is based on the Corps' commitments to: (1) avoid direct impacts by maintaining buffers around sensitive habitat and/or conducting construction activities outside of sensitive timeframes (e.g., during the giant garter snake active window or fledging period of special-status birds); (2) minimize temporary habitat losses through the incorporation of on-site mitigation features (e.g., constructed wetland trenches, riparian plantings as discussed in section 4.3.4, and anchored IWM) in the project design; (3) implement a stormwater pollution prevention plan (SWPPP) and associated BMPs, as described in section 4.4.4; and (4) offset permanent, incremental adverse effects of riprap on fluvial processes and associated habitat values through the implementation of proven conservation measures (e.g., setback levees, removal of riprap) at an off-site conservation area (see sections 4.3.4 and 2.10). Concurrent implementation of these conservation measures would adequately avoid, minimize, and mitigate adverse effects on the special-status wildlife and fish species discussed in this document. Finally, as of present, no special-status plants are documented to occur on the project sites. However, if such species are documented during the planned surveys in spring/summer 2007, the proposed action is not likely to result in jeopardy to these species, as long as the applicable protection and mitigation measures, as detailed in section 4.3.4 of the EA, are adhered to.

f. <u>Proposed Disposal Site Determinations</u>

(1) Mixing Zone Determination (consider factors in section 230.11(f)(2))

Not applicable.

(2) Determination of Compliance with Applicable Water Quality Standards (present the standards and rationale for compliance or non-compliance with each standard)

With the exception of temporary impacts on turbidity (discussed above in Section "e. Suspended Particulate/ Turbidity Determinations"), water quality or effluent standards would not be violated either during or after construction.

(3) Potential Effects on Human Use Characteristics

The proposed project would not have any significant adverse effects on municipal and private water supply, or commercial fisheries. There would be no national and historic monuments, parks, seashores, wilderness areas, research sites, or similar preserves affected by the proposed project. Recreational fisheries and water-related recreation would be temporarily adversely affected during construction, as discussed in more detail below.

During Phase 2 construction from June through November, the erosion site locations and immediate areas adjacent to the sites would be closed to the public. Detours and alternate routes would be implemented as necessary. Most of the erosion sites are inaccessible due to steep slopes, so river access would not be displaced as a result of construction. However, at Site RM 47.9R, the dock located within the construction area would likely be closed to pedestrian traffic while the project is being implemented. It is anticipated that the barge and tugboats would occupy approximately 200 feet of the river channel. Access to docks and marinas may be temporarily halted due to the presence of construction equipment (boats, barges, landside staging and storage material) working at this location. Boat access to the docks at Sites RM 33.0R and 47.9R may be prohibited during construction.

The placement of soil, riprap, vegetation, and IWM along the bank would be designed to enhance the natural qualities of the area. Fishing, boating, and swimming opportunities in the area would remain substantially the same as before construction, with the exception of the temporary closures of the construction site areas for public safety purposes.

Most existing trees would remain in place to provide shade, nesting, and quality habitat for wildlife. The installation of rocks, soil and native vegetation, IWM, and their post-construction appeal to the public would not be substantially diminished when compared to existing conditions. As a result, there would be no substantial loss of recreational values at each erosion site.

g. <u>Determination of Cumulative Effects on the Aquatic Ecosystem</u> (consider requirements in Section 230.11(g))

The proposed project would not have any significant cumulative effects on the aquatic ecosystem. The proposed project would result in the creation of approximately 0.21 acres of vegetated shallows and the addition of 3,738 LF of IWM, covering at least 1,765 LF of the total project bankline of 4,411 LF (approx 40%). Because this represents a substantial increase of the baseline cover habitat for listed salmonids, a key indicator species of river health, cumulative long-term effects on the aquatic ecosystem should be considered beneficial.

h. <u>Determination of Secondary Effects on the Aquatic Ecosystem</u> (consider requirements in Section 230.11(h))

The proposed project would not have any secondary effects on the aquatic ecosystem. The proposed project would result in the creation of approximately 0.67 acres of vegetated shallows and the addition of 6,753 LF of IWM, covering approximately 90% of the total project bankline. Because this represents a substantial increase of the baseline cover habitat for listed salmonids, a key indicator species of river health, cumulative long-term effects on the aquatic ecosystem should be considered beneficial.

III. Findings of Compliance or Non-Compliance with the Restrictions on Discharge

a. <u>Adaptation of the Section 404(b)(1) Guidelines to this Evaluation</u>

No significant adaptations of the guidelines were made relative to this evaluation.

b. <u>Evaluation of Availability of Practicable Alternatives to the Proposed Discharge Site Which Would Have Less Impact on the Aquatic Ecosystem</u>

There were no alternatives identified that would have significantly less adverse effects on the aquatic ecosystem than the proposed alternative.

c. <u>Compliance with Applicable State Water Quality Standards and</u>
d. <u>Compliance with Applicable Toxic Effluent Standard or Prohibition Under Section 307 of the Clean Water Act</u>

State water quality standards would not be violated. The proposed action would not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

e. Compliance with Endangered Species Act (ESA) of 1973

Formal consultation was initiated with NMFS and USFWS on October 31, 2006. It is anticipated that biological opinions will be issued on or prior to December 22, 2006 (K. Turner, USFWS, Sacramento, California, pers. comm., 2006).

f. Compliance with Specified Protection Measures for Marine Sanctuaries Designated by the Marine Protection, Research, and Sanctuaries Act of 1972

Not applicable.

g. Evaluation of Extent of Degradation of the Waters of the United States

(1) Significant Adverse Effects on Human Health and Welfare

The proposed project would not cause significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing (other than construction-related effects on recreational fishing access, which would be temporary and less than significant). Construction activities would have temporary effects on benthic communities and plankton. There would be temporary adverse effects to fish, shellfish, wildlife or special aquatic sites. The proposed project would not significantly affect recreation or economic values. Temporary effects on aesthetics would occur during construction only, and would have a net long-term benefit due to establishment of additional riparian vegetation at each site.

h. Appropriate and Practicable Steps Taken to Minimize Potential Adverse Impacts of the Discharge on the Aquatic Ecosystem

i. On the Basis of the Guidelines, the Proposed Disposal Site(s) for the discharge of fill material complies with the requirements of these guidelines.

Appropriate and practicable steps to minimize potential adverse effects of discharge and fill on the aquatic ecosystem include: placing fill material only where it is needed for the proposed project and confining it to the smallest practicable area. The areas disturbed by construction would be returned as close as possible to pre-project conditions where practicable.

On the basis of the guidelines, the proposed project is specified as complying with the inclusion of appropriate and practical conditions to minimize pollution or adverse effect on the aquatic ecosystem

IV. References

APHA. 1998. Standard methods for the examination of water and wastewater. American Public Health Association, Washington, D.C.

Fris, M. B. and R. W. DeHaven. 1993. A community-based Habitat Suitability Index model for Shaded Riverine Aquatic Cover, selected reaches of the Sacramento River system (draft). USDI, FWS, Sacramento Field Office, CA. 23 pp.

USFWS (U.S. Fish and Wildlife Service). 1999. Conservation Guidelines for the Valley Elderberry Longhorn Beetle. U.S. Fish and Wildlife Service, Sacramento, CA.

USFWS (U. S. Fish and Wildlife Service). 2006. Re: Response to the October 31, 2006 initiation of formal Section 7 ESA consultation for the Sacramento River Bank Protection Project, Sacramento River Mile 16.9L, 33.0R, 33.3R, 43.7R, 44.7R, 47.0L, 47.9R, 48.2R, 62.5R, and 68.9L, and Steamboat Slough River Mile 19.0R, 19.4R, and 22.7R in Sacramento and Yolo counties, California. Record No. 1-1-07-I-0110. Letter from Susan Moore, Field Supervisor, USFWS, Sacramento, California to Scott E. Clark, Chief, Planning Division, U. S. Army Corps of Engineers, Sacramento, California. 1 November.

Appendix F

Air Quality Emissions Data

Road Construction Emissions Model, Version 5.2

Emission Estimates for -> Waterside construction (phase I and II)					Exhaust	Fugitive Dust	
Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	
Grubbing/Land Clearing	0	0	0	0	0	0	
Grading/Excavation	20	96	135	8	8	0	
Drainage/Utilities/Sub-Grade	0	0	0	0	0	0	
Paving	0	0	0	0	0	0	
Maximum (pounds/day)	20	96	135	8	8	0	
Total (tons/construction project)	0.63	2.84	4.31	0.24	0.24	0.00	<-tons

Notes: Project Start Year ->	2006
Project Length (months) ->	4
Total Project Area (acres) ->	1
Maximum Area Disturbed/Day (acres) ->	0
Total Soil Imported/Exported (yd^3/day)->	81

PM10 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I.

Emission Estimates for -> Waterside construction (phase I and II)					Exhaust	Fugitive Dust	
Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	
Grubbing/Land Clearing	0	0	0	0	0	0	
Grading/Excavation	9	43	61	4	4	0	
Drainage/Utilities/Sub-Grade	0	0	0	0	0	0	
Paving	0	0	0	0	0	0	
Maximum (kilograms/day)	9	43	61	4	4	0	
Total (megagrams/construction project)	0.57	2.58	3.91	0.22	0.22	0.00	<-megagrams

Notes: Project Start Year ->	2006
Project Length (months) ->	4
Total Project Area (hectares) ->	0
Maximum Area Disturbed/Day (hectares) ->	0
Total Soil Imported/Exported ($meters^3$/day)->	62

PM10 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I.

Figure 1. Emissions estimates for sites undergoing waterside construction during phase I and II (Sites RM 16.9L, 19.0R, 19.4R, 22.7R, 33.0R, 33.3R, 43.7R, 44.7R, and 47.9R). Total Project area and total soil imported/exported vary by site, but emission estimates are the same for all the aforementioned sites due to common assumptions about equipment usage.

Road Construction Emissions Model, Version 5.2

Emission Estimates for -> Waterside construction (phase I)					Exhaust	Fugitive Dust	
Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	
Grubbing/Land Clearing	0	0	0	0	0	0	
Grading/Excavation	18	87	123	7	7	0	
Drainage/Utilities/Sub-Grade	0	0	0	0	0	0	
Paving	0	0	0	0	0	0	
Maximum (pounds/day)	18	87	123	7	7	0	
Total (tons/construction project)	0.29	1.29	1.97	0.11	0.11	0.00	<-tons

Notes: Project Start Year -> 2006
Project Length (months) -> 2
Total Project Area (acres) -> 1
Maximum Area Disturbed/Day (acres) -> 0
Total Soil Imported/Exported (yd^3/day)-> 233

PM10 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I.

Emission Estimates for -> Waterside construction (phase I)					Exhaust	Fugitive Dust	
Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	
Grubbing/Land Clearing	0	0	0	0	0	0	
Grading/Excavation	8	40	56	3	3	0	
Drainage/Utilities/Sub-Grade	0	0	0	0	0	0	
Paving	0	0	0	0	0	0	
Maximum (kilograms/day)	8	40	56	3	3	0	
Total (megagrams/construction project)	0.26	1.17	1.79	0.10	0.10	0.00	<-megagrams

Notes: Project Start Year -> 2006
Project Length (months) -> 2
Total Project Area (hectares) -> 0
Maximum Area Disturbed/Day (hectares) -> 0
Total Soil Imported/Exported ($meters^3$/day)-> 178

PM10 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I.

Figure 2. Phase I emissions estimates for sites undergoing waterside construction during phase I only (Sites RM 47.0L, 48.2R, 62.5R, 68.9L, and 78.0L). Total Project area and total soil imported/exported vary by site, but emission estimates are the same for all the aforementioned sites due to common assumptions about equipment usage.

Road Construction Emissions Model, Version 5.2

Emission Estimates for -> RM 47.0L (phase II)

Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	
Grubbing/Land Clearing	0	0	0	0	0	0	
Grading/Excavation	18	110	139	12	7	5	
Drainage/Utilities/Sub-Grade	0	0	1	0	0	0	
Paving	0	0	0	0	0	0	
Maximum (pounds/day)	18	110	139	12	7	5	
Total (tons/construction project)	0.28	1.78	2.11	0.18	0.11	0.08	<-tons

Notes: Project Start Year -> 2006
Project Length (months) -> 2
Total Project Area (acres) -> 2
Maximum Area Disturbed/Day (acres) -> 0
Total Soil Imported/Exported (yd^3/day)-> 135

PM10 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I.

Emission Estimates for -> RM 47.0L (phase II)

Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	PM10 (kgs/day)	Exhaust PM10 (kgs/day)	Fugitive Dust PM10 (kgs/day)	
Grubbing/Land Clearing	0	0	0	0	0	0	
Grading/Excavation	8	50	63	5	3	2	
Drainage/Utilities/Sub-Grade	0	0	0	0	0	0	
Paving	0	0	0	0	0	0	
Maximum (kilograms/day)	8	50	63	5	3	2	
Total (megagrams/construction project)	0.26	1.62	1.91	0.17	0.10	0.07	<-megagrams

Notes: Project Start Year -> 2006
Project Length (months) -> 2
Total Project Area (hectares) -> 1
Maximum Area Disturbed/Day (hectares) -> 0
Total Soil Imported/Exported ($meters^3$/day)-> 103

PM10 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I.

Figure 3. Phase II emission estimates for Site RM 47.0L, landside construction.

Road Construction Emissions Model, Version 5.2

Emission Estimates for -> RM 48.2R (phase II)					Exhaust	Fugitive Dust	
Project Phases (English Units)	**ROG (lbs/day)**	**CO (lbs/day)**	**NOx (lbs/day)**	**PM10 (lbs/day)**	**PM10 (lbs/day)**	**PM10 (lbs/day)**	
Grubbing/Land Clearing	0	0	0	0	0	0	
Grading/Excavation	20	129	162	12	7	5	
Drainage/Utilities/Sub-Grade	0	0	1	0	0	0	
Paving	0	0	0	0	0	0	
Maximum (pounds/day)	20	129	162	12	7	5	
Total (tons/construction project)	0.31	2.14	2.42	0.19	0.12	0.08	<-tons

Notes: Project Start Year -> 2006

Project Length (months) -> 2

Total Project Area (acres) -> 2

Maximum Area Disturbed/Day (acres) -> 0

Total Soil Imported/Exported (yd^3/day)-> 204

PM10 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I.

Emission Estimates for -> RM 48.2R (phase II)					Exhaust	Fugitive Dust	
Project Phases (Metric Units)	**ROG (kgs/day)**	**CO (kgs/day)**	**NOx (kgs/day)**	**PM10 (kgs/day)**	**PM10 (kgs/day)**	**PM10 (kgs/day)**	
Grubbing/Land Clearing	0	0	0	0	0	0	
Grading/Excavation	9	59	73	6	3	2	
Drainage/Utilities/Sub-Grade	0	0	0	0	0	0	
Paving	0	0	0	0	0	0	
Maximum (kilograms/day)	9	59	73	6	3	2	
Total (megagrams/construction project)	0.28	1.94	2.19	0.18	0.11	0.07	<-megagrams

Notes: Project Start Year -> 2006

Project Length (months) -> 2

Total Project Area (hectares) -> 1

Maximum Area Disturbed/Day (hectares) -> 0

Total Soil Imported/Exported ($meters^3$/day)-> 156

PM10 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I.

Figure 4. Phase II emission estimates for Site RM 48.2R, landside construction.

Road Construction Emissions Model, Version 5.2

Emission Estimates for -> RM 62.5R (phase II)					Exhaust	Fugitive Dust	
Project Phases (English Units)	**ROG (lbs/day)**	**CO (lbs/day)**	**NOx (lbs/day)**	**PM10 (lbs/day)**	**PM10 (lbs/day)**	**PM10 (lbs/day)**	
Grubbing/Land Clearing	0	0	0	0	0	0	
Grading/Excavation	15	76	100	11	6	5	
Drainage/Utilities/Sub-Grade	0	0	1	0	0	0	
Paving	0	0	0	0	0	0	
Maximum (pounds/day)	15	76	100	11	6	5	
Total (tons/construction project)	0.23	1.17	1.58	0.17	0.09	0.08	<-tons

Notes: Project Start Year -> 2006

Project Length (months) -> 2

Total Project Area (acres) -> 1

Maximum Area Disturbed/Day (acres) -> 0

Total Soil Imported/Exported (yd^3/day)-> 55

PM10 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I.

Emission Estimates for -> RM 62.5R (phase II)					Exhaust	Fugitive Dust	
Project Phases (Metric Units)	**ROG (kgs/day)**	**CO (kgs/day)**	**NOx (kgs/day)**	**PM10 (kgs/day)**	**PM10 (kgs/day)**	**PM10 (kgs/day)**	
Grubbing/Land Clearing	0	0	0	0	0	0	
Grading/Excavation	7	35	45	5	3	2	
Drainage/Utilities/Sub-Grade	0	0	0	0	0	0	
Paving	0	0	0	0	0	0	
Maximum (kilograms/day)	7	35	45	5	3	2	
Total (megagrams/construction project)	0.21	1.06	1.43	0.15	0.08	0.07	<-megagrams

Notes: Project Start Year -> 2006

Project Length (months) -> 2

Total Project Area (hectares) -> 0

Maximum Area Disturbed/Day (hectares) -> 0

Total Soil Imported/Exported ($meters^3$/day)-> 42

PM10 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I.

Figure 5. Phase II emission estimates for Site RM 62.5R, landside construction.

Road Construction Emissions Model, Version 5.2

Emission Estimates for -> RM 68.9L (phase II)

Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	
Grubbing/Land Clearing	0	0	0	0	0	0	
Grading/Excavation	21	146	180	13	8	5	
Drainage/Utilities/Sub-Grade	0	0	1	0	0	0	
Paving	0	0	0	0	0	0	
Maximum (pounds/day)	21	146	180	13	8	5	
Total (tons/construction project)	0.34	2.44	2.67	0.20	0.13	0.08	<-tons

Notes: Project Start Year -> 2006
Project Length (months) -> 2
Total Project Area (acres) -> 2
Maximum Area Disturbed/Day (acres) -> 0
Total Soil Imported/Exported (yd^3/day)-> 255

PM10 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I.

Emission Estimates for -> RM 68.9L (phase II)

Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	PM10 (kgs/day)	Exhaust PM10 (kgs/day)	Fugitive Dust PM10 (kgs/day)	
Grubbing/Land Clearing	0	0	0	0	0	0	
Grading/Excavation	10	66	82	6	4	2	
Drainage/Utilities/Sub-Grade	0	0	0	0	0	0	
Paving	0	0	0	0	0	0	
Maximum (kilograms/day)	10	66	82	6	4	2	
Total (megagrams/construction project)	0.31	2.21	2.43	0.18	0.11	0.07	<-megagrams

Notes: Project Start Year -> 2006
Project Length (months) -> 2
Total Project Area (hectares) -> 1
Maximum Area Disturbed/Day (hectares) -> 0
Total Soil Imported/Exported ($meters^3$/day)-> 195

PM10 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I.

Figure 6. Phase II emission estimates for Site at 68.9L, landside construction.

Road Construction Emissions Model, Version 5.2

Emission Estimates for -> RM 78.0L (phase II)

Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	
Grubbing/Land Clearing	0	0	0	0	0	0	
Grading/Excavation	23	161	199	13	8	5	
Drainage/Utilities/Sub-Grade	0	0	1	0	0	0	
Paving	0	0	0	0	0	0	
Maximum (pounds/day)	23	161	199	13	8	5	
Total (tons/construction project)	0.36	2.73	2.92	0.21	0.13	0.08	<-tons

Notes: Project Start Year -> 2006
Project Length (months) -> 2
Total Project Area (acres) -> 2
Maximum Area Disturbed/Day (acres) -> 0
Total Soil Imported/Exported (yd^3/day)-> 273

PM10 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I.

Emission Estimates for -> RM 78.0L (phase II)

Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	PM10 (kgs/day)	Exhaust PM10 (kgs/day)	Fugitive Dust PM10 (kgs/day)	
Grubbing/Land Clearing	0	0	0	0	0	0	
Grading/Excavation	10	73	90	6	4	2	
Drainage/Utilities/Sub-Grade	0	0	0	0	0	0	
Paving	0	0	0	0	0	0	
Maximum (kilograms/day)	10	73	90	6	4	2	
Total (megagrams/construction project)	0.33	2.47	2.65	0.19	0.12	0.07	<-megagrams

Notes: Project Start Year -> 2006
Project Length (months) -> 2
Total Project Area (hectares) -> 1
Maximum Area Disturbed/Day (hectares) -> 0
Total Soil Imported/Exported ($meters^3$/day)-> 209

PM10 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I.

Figure 7. Phase II emission estimates for Site RM 78.0L, landside construction.

Appendix G

2006 Site Reconnaissance Photographs

a) Site RM 16.9L riparian vegetation, November 2006.

b) Site RM 16.9L waterside, July 2006, Ayres Associates.

Figure G-1. Site reconnaissance photographs at Site RM 16.9L.

a) Site RM 19.0R riparian vegetation, November 2006.

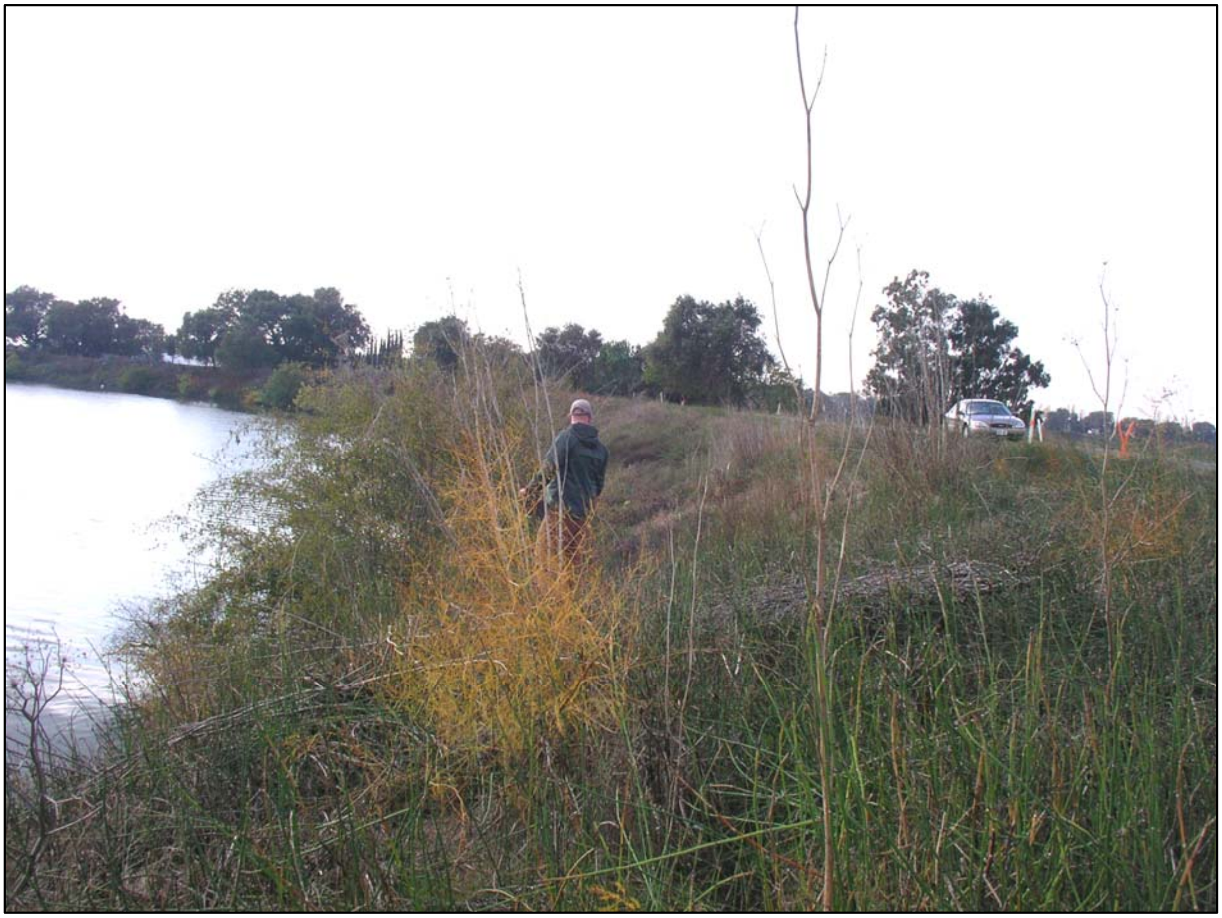
b) Site RM 19.0R waterside, November 2006.

Figure G-2. Site reconnaissance photographs at Site RM 19.0R.

a) Site RM 19.4R riparian vegetation, November 2006.

b) Site RM 19.4R waterside, November 2006.

Figure G-3. Site reconnaissance photographs at Site RM 19.4R.



a) Site RM 22.7R riparian vegetation, November 2006.

b) Site RM 22.7R waterside, November 2006.

Figure G-4. Site reconnaissance photographs at Site RM 22.7R.

a) Site RM 33.0R riparian vegetation, November 2006.

b) Site RM 33.0R waterside, July 2006, Ayres Associates.

Figure G-5. Site reconnaissance photographs at Site RM 33.0R.

a) Site RM 33.3R riparian vegetation, November 2006.

b) Site RM 33.3R waterside, July 2006, Ayres Associates.

Figure G-6. Site reconnaissance photographs at Site RM 33.3R.

a) Site RM 43.7R riparian vegetation, November 2006.

b) Site RM 43.7R waterside, July 2006, Ayres Associates.

Figure G-7. Site reconnaissance photographs at Site RM 43.7R.

a) Site RM 44.7L riparian vegetation, November 2006.

b) Site RM 44.7L waterside, July 2006, Ayres Associates.

Figure G-8. Site reconnaissance photographs at Site RM 44.7L.

a) Site RM 47.0L riparian vegetation, November 2006.

b) Site RM 47.0L waterside, July 2006, Ayres Associates.

Figure G-9. Site reconnaissance photographs at Site RM 47.0L.

a) Site RM 47.9L riparian vegetation, November 2006.

b) Site RM 47.9L waterside, July 2006, Ayres Associates.

Figure G-10. Site reconnaissance photographs at Site RM 47.9L.

a) Site RM 48.2R riparian vegetation, November 2006.

b) Site RM 48.2R waterside, July 2006, Ayres Associates.

Figure G-11. Site reconnaissance photographs at Site RM 48.2R

a) Site RM 62.5R riparian vegetation, November 2006.

b) Site RM 62.5R waterside, July 2006, Ayres Associates.

Figure G-12. Site reconnaissance photographs at Site RM 62.5R.

a) Site RM 68.9L riparian vegetation, November 2006.

b) Site RM 68.9L waterside, July 2006, Ayres Associates.

Figure G-13. Site reconnaissance photographs at Site RM 68.9L.

a) Site RM 78.0L riparian vegetation, November 2006.

b) Site RM 78.0L waterside, July 2006, Ayres Associates.

Figure G-14. Site reconnaissance photographs at Site RM 78.0L.

Appendix H

Hazardous, Toxic and Radioactive Waste Assessment

HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE ASSESSMENT
Sacramento River Bank Protection Project
Sacramento River and Tributaries, California

Prepared for:

Ayres Associates
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November 21, 2006

Prepared by:

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APPENDICES (Available on CD only)

1.0 EXECUTIVE SUMMARY

MECX, LLC (MECX) has performed a hazardous, toxic and radioactive waste (HTRW) site assessment for 14 sites located in California along the Sacramento River and its tributary, Steamboat Slough (Sites), pursuant to the United States Army Corp of Engineers (USACE) Engineering Regulation (ER) 1165-2-132. This HTRW assessment has revealed no recognized environmental conditions (RECs) in connection with the Sites, except for those described below.

Possible Recognized Environmental Conditions

- Remedial Investigation Near SAC16.9L – Currently a remedial investigation is occurring for a leaking gasoline UST discovered at a site (Isleton General Sore/Dunn) south of SAC16.9L. total petroleum hydrocarbons and volatile organic constituents have been detected in the Dunn site monitoring wells and data from the investigation indicate that the contamination is migrating west, toward SAC16.9L.

  A subsurface investigation would be necessary to determine if the leaking UST has adversely affected SAC16.9L.

- Potential Contamination Near SAC47.0L – Historical aerial photographs indicate that the area designated for site parking has been used for material storage since at least 1971. At the time of the site reconnaissance, old creosote railroad ties and open, rusting drums containing railroad spikes were stored in this area. Depending on the nature of materials stored in this area and the storage practices, soils under the parking area may be impacted with unknown contaminants which may have migrated to the soils and sediments of SAC47.0L.

  A subsurface investigation would be necessary to determine if past practices have adversely affected SAC47.0L.

- Remedial Investigations Near SAC62.5R – One facility near SAC62.5R is currently undergoing a remedial investigation and two others have been the focus of remedial investigations in the past. The current remedial investigation is at the Petroleum Tank Line, located about 4000 feet south-southeast of SAC62.5R. This site is impacted by diesel fuel and volatile organic constituent contamination. Groundwater flow data available from this site indicate that the contamination could potentially move toward SAC62.5R. The other two sites, Home Depot and the Riverpoint Business Park, are also south of SAC62.5R. Soils at the Home Depot site are impacted by arsenic through the historical use of arsenic-containing pesticides. Soils at Riverpoint Business Park are impacted by lead from historical practices at a former battery recycling facility. While metals are not as mobile as organic constituents, these sites are close to SAC62.5R and the contamination has been present for many years. Therefore, the contamination associated with these sites, arsenic and lead, may affect SAC62.5R.

> *A subsurface investigation would be necessary to determine if SAC62.5R is adversely affected by diesel, volatile organic constituents, arsenic, or lead.*

Following this Executive Summary, Section 2.0 provides the HTRW assessment of the Sites. Section 3.0 presents the results of MEC^{X} HTRW assessment of the Sites. Documentation for the activities described herein is provided in the Appendices at the end of this report.

2.0 HTRW SITE ASSESSMENTS

2.1 INTRODUCTION

This report presents the findings of a hazardous, toxic and radioactive waste (HTRW) assessment of the Sites. Ayers Associates (Client) retained MEC^X to conduct this assessment in accordance with the terms of the Environmental Consulting Services Agreement between MEC^X and Client dated November 3, 2006.

2.1.1 Purpose

This report is provided to Client for the purpose of identifying possible HTRW that may be located within USACE project boundaries or that may affect or be affected by USACE projects.

2.1.2 Scope of Services

This HTRW assessment was conducted according to USACE ER 1165-2-132.

2.1.3 Significant Assumptions

In conducting the HTRW assessment, MEC^X made the assumptions below.

- MEC^X would have the timely, unrestricted access necessary to complete the scope of work.
- In general, when groundwater flow information is not available, it is assumed to mimic the topographic gradient. Near rivers, however, groundwater flow is assumed to vary with the seasonal river flow. In times of low river flow, groundwater is assumed to flow toward the river and with the flow of the river. In high river flow, groundwater is assumed to move away from the river to recharge the groundwater system.

2.1.4 Limitations and Exceptions

The accuracy and completeness of this report is necessarily limited by the following:

- Access limitations – None;
- Physical obstructions – Direct visualization of approximately one-third of Sacramento River Site River Mile 68.9L was precluded due to the presence of a backhoe performing shrub and tree-trimming activities. Upon arrival at the Site, MEC^X found that shrubs in the lower third of the site had been trimmed, leaving significant amounts of debris and rendering visualization of the ground impossible. Additionally, debris blocked the only viable access point to waterline. River bank slope, vegetation density, leaf litter, deadfall, and/or slash piles precluded direct visualization of the ground in some places at all Sites;
- Historical Data Source Failure – Sanborn Fire Insurance maps were not available for any Site.

2.1.5 Special Terms and Conditions

In conducting the HTRW assessment, MEC^X employed technical judgments within the constraints of time and scope of the project. MEC^X's conclusions are based on the conditions existing at the time of the Site inspections. Past conditions which were not observable, were established by review of standard environmental sources. MEC^X depended on readily available information, without subjecting it to any further independent verification.

2.2 SITE DESCRIPTIONS

2.2.1 Sacramento River Site River Mile 16.9 L

Sacramento River Site River Mile 16.9 L (SAC16.9L) is located on the left bank of the Sacramento River, within the town of Isleton in Sacramento Country, California, at historical river mile 16.9. The bank protection footprint is approximately 210 feet long, encompasses approximately 1.2 acres, and parallels and is accessed from Highway 160. The construction easement is approximately 420 feet long and encompasses approximately 3.3 acres. Waypoints that describe the footprint of the bank protection site and the construction footprint are listed in Table 1. Access to the Site was limited in places by the steep bank and dense vegetation.

Table 1. Approximate Limits of SAC16.9L

Bank Protection Footprint		Construction Footprint	
Northing	**Easting**	**Northing**	**Easting**
38.162842º	-121.617188º	38.162896º	-121.617645º
38.163667º	-121.616955º	38.164028º	-121.617419º
38.163600º	-121.616158º	38.163726º	-121.615941º
38.162766º	-121.616402º	38.162716º	-121.616117º

The properties in the immediate vicinity of the Site are located on the south side of Highway 160 and are agricultural or developed for residential use. Properties directly across Highway 160 from the Site include three private homes and portion of an unplanted field.

2.2.2 Steamboat Slough Site River Mile 19.0 R

Steamboat Slough Site River Mile 19.0 R (STE19.0R) is located on the right bank of the Steamboat Slough in Yolo Country, California, at historical river mile 19.0. The bank protection footprint is approximately 550 feet long, encompasses approximately 2.1 acres, and parallels and is accessed from Ryer Road. The construction easement is approximately 700 feet long and encompasses approximately 3.3 acres. Waypoints that describe the footprint of the bank protection site and the construction footprint are listed in Table 2. Access to the lower bank of the Site was limited in places by the steep bank and dense vegetation.

Table 2. Approximate Limits of STE19.0R

Bank Protection Footprint		Construction Footprint	
Northing	**Easting**	**Northing**	**Easting**
38.215769º	-121.607773º	38.215528º	-121.608048º
38.216920º	-121.606549º	38.214964º	-121.606847º
38.216554º	-121.605831º	38.217160º	-121.606307º
38.215445º	-121.606987º	38.216687º	-121.605376º

The properties in the immediate vicinity of the Site are located on the west side of Ryer Road and are agricultural or developed for residential use. The property directly across Ryer Road from the Site includes a private home and an agricultural field.

2.2.3 Steamboat Slough Site River Mile 19.4 R

Steamboat Slough Site River Mile 19.4 R (STE19.4R) is located on the right bank of the Steamboat Slough, Yolo Country, California, at historical river mile 19.4. The bank protection footprint is approximately 275 feet long, encompasses approximately 1.2 acres, and parallels and is accessed from Ryer Road. The construction easement is approximately 515 feet long and encompasses approximately 3.4 acres. Waypoints that describe the footprint of the bank protection site and the construction footprint are listed in Table 3. Access to the lower bank of the Site was limited by the steep bank and dense vegetation.

Table 3. Approximate Limits of STE19.4R

Bank Protection Footprint		Construction Footprint	
Northing	**Easting**	**Northing**	**Easting**
38.220566º	-121.603908º	38.220827º	-121.603768º
38.220332º	-121.603060º	38.220568º	-121.602650º
38.219830º	-121.604322º	38.219655º	-121.604467º
38.219517º	-121.603508º	38.219130º	-121.603514º

The properties in the immediate vicinity of the Site are located on the west side of Ryer Road and are agricultural or developed for residential use. The property directly across Ryer Road from the Site is an agricultural field.

2.2.4 Steamboat Slough Site River Mile 22.7 R

Steamboat Slough Site River Mile 22.7 R (STE22.7R) is located on the right bank of the Steamboat Slough, Sacramento Country, California, at historical river mile 22.7. The bank protection footprint is approximately 220 feet long, encompasses approximately

1.1 acres, and parallels and is accessed from Sutter Island Road. The construction easement is approximately 380 feet long and encompasses approximately 2.1 acres. Waypoints that describe the footprint of the bank protection site and the construction footprint are listed in Table 4. Access to the lower bank of the Site was limited by the steep bank and access to the upper bank was limited by dense vegetation.

Table 4. Approximate Limits of STE22.7R

Bank Protection Footprint		**Construction Footprint**	
Northing	**Easting**	**Northing**	**Easting**
38.262673º	-121.593223º	38.262606º	-121.593437º
38.262132º	-121.593067º	38.261870º	-121.593245º
38.262813º	-121.592136º	38.262790º	-121.591567º
38.262288º	-121.592150º	38.262015º	-121.591510º

The properties in the immediate vicinity of the Site are located on the north side of Sutter Island Road and are agricultural or developed residential use. The property directly across Sutter Island Road from the Site is an agricultural field.

2.2.5 Sacramento River Site River Mile 33.0 R

Sacramento River Site River Mile 33.0 R (SAC33.0R) is located on the right bank of the Sacramento River, in Sacramento Country, California, at historical river mile 33.0. The bank protection footprint is approximately 325 feet long, encompasses approximately 0.75 acres, and parallels and is accessed from Highway 160. The construction easement is approximately 550 feet long and encompasses approximately 2.7 acres. Waypoints that describe the footprint of the bank protection site and the construction footprint are listed in Table 5. Access to the Site was limited in places by the steep bank and dense vegetation.

Table 5. Approximate Limits of SAC33.0R

Bank Protection Footprint		**Construction Footprint**	
Northing	**Easting**	**Northing**	**Easting**
38.313056º	-121.578758º	38.312686º	-121.578694º
38.313125º	-121.578172º	38.312895º	-121.577764º
38.313845º	-121.578879º	38.314209º	-121.5790006º
38.313830º	-121.578305º	38.314285º	-121.578044º

The properties in the immediate vicinity of the Site are located on the west side of Highway 160 and are agricultural of are developed for residential use. The property directly across Highway 160 from the Site includes one private home and an agricultural field.

2.2.6 Sacramento River Site River Mile 33.3 R

Sacramento River Site River Mile 33.3 R (SAC33.3R) is located on the right bank of the Sacramento River, in Sacramento Country, California, at historical river mile 33.3. The bank protection footprint is approximately 235 feet long, encompasses approximately 1.0 acre, and parallels and is accessed from Highway 160. The construction easement is approximately 450 feet long and encompasses approximately 3.0 acres. Waypoints that describe the footprint of the bank protection site and the construction footprint are listed in Table 6. Access to the Site was limited in places by the steep bank and dense vegetation.

Table 6. Approximate Limits of SAC33.3R

Bank Protection Footprint		Construction Footprint	
Northing	**Easting**	**Northing**	**Easting**
38.318863º	-121.578844º	38.318583º	-121.578953º
38.318809º	-121.578352º	38.318500º	-121.578103º
38.319730º	-121.578687º	38.319875º	-121.578664º
38.319694º	-121.578201º	38.319821º	-121.577889º

The properties in the immediate vicinity of the Site are located on the west side of Highway 160 and are agricultural or are developed for residential use. The property directly across Highway 160 from the Site includes one private home and an agricultural field.

2.2.7 Sacramento River Site River Mile 43.7 R

Sacramento River Site River Mile 43.7 R (SAC43.7R) is located on the right bank of the Sacramento River, in Yolo Country, California, at historical river mile 43.7. The bank protection footprint is approximately 1080 feet long, encompasses approximately 6.4 acres, and parallels and is accessed from River Road. The construction easement is approximately 1340 feet long and encompasses approximately 11.4 acres. Waypoints that describe the footprint of the bank protection site and the construction footprint are listed in Table 7. Access to the Site was limited in places by the steep bank and dense vegetation.

Table 7. Approximate Limits of SAC43.7R

Bank Protection Footprint		Construction Footprint	
Northing	**Easting**	**Northing**	**Easting**
38.436063º	-121.526927º	38.436066º	-121.527544º
38.435439º	-121. 526797º	38.435016º	-121.527476º
38.435832º	-121.523045º	38.435797º	-121.522761º
38.435205º	-121.523019º	38.434958º	-121.522777º

The properties in the immediate vicinity of the Site are located on the north side of River Road and are agricultural or are developed for residential use. Properties directly across River Road from the Site include three private homes backed by agricultural fields.

2.2.8 Sacramento River Site River Mile 44.7 R

Sacramento River Site River Mile 44.7 R (SAC44.7R) is located on the right bank of the Sacramento River, in Yolo Country, California, at historical river mile 44.7. The bank protection footprint is approximately 1580 feet long, encompasses approximately 7.3 acres, and parallels and is accessed from River Road. The construction easement is approximately 1720 feet long and encompasses approximately 13.4 acres. Waypoints that describe the footprint of the bank protection site and the construction footprint are listed in Table 8. Access to the Site was limited in places by the steep bank and dense vegetation.

Table 8. Approximate Limits of SAC44.7R

Bank Protection Footprint		Construction Footprint	
Northing	**Easting**	**Northing**	**Easting**
38.436532º	-121.511715º	38.436441º	-121.512091º
38.435853º	-121.511449º	38.438461º	-121.511661º
38.438560º	-121.506945º	38.438700º	-121.506731º
38.438127º	-121.506536º	38.438098º	-121.506112º

The properties in the immediate vicinity of the Site are located on the north side of River Road and are agricultural or are developed for residential use. Properties directly across River Road from the Site include four private homes and agricultural fields.

2.2.9 Sacramento River Site River Mile 47.0 L

Sacramento River Site River Mile 47.0 L (SAC47.0L) is located on the left bank of the Sacramento River, at the northern limits of the town of Freeport in Sacramento Country, California, at historical river mile 47.0. The bank protection footprint is approximately 1160 feet long, encompasses approximately 9.3 acres, and parallels and is accessed from Freeport Boulevard. The construction easement is approximately 1430 feet long and encompasses approximately 13.8 acres. Waypoints that describe the footprint of the bank protection site and the construction footprint are listed in Table 9. Access to the Site was limited in places by Sacramento storm water outfalls, the steep bank and dense vegetation.

Table 9. Approximate Limits of SAC47.0L

Bank Protection Footprint		**Construction Footprint**	
Northing	**Easting**	**Northing**	**Easting**
38.468518º	-121.503574º	38.471951º	-121.505085º
38.468484º	-121.504366º	38.471419º	-121.505903º
38.471731º	-121.504931º	38.468206º	-121.503521º
38.471307º	-121.505569º	38.468196º	-121.504591º

The properties in the immediate vicinity of the Site are located primarily on the east side of Freeport Boulevard and are developed for commercial and recreational use. Properties directly across Freeport Boulevard from the Site include an athletic complex with soccer and baseball fields, a Sacramento storm water outfall pumping station, and an office complex. Immediately adjacent to the Site and on the same side of Freeport Boulevard is a small Sacramento drinking water treatment plant. Additionally, the entire eastern edge of the side is bounded by abandoned railroad tracks and a storage area currently housing railroad ties, spikes, and gravel.

2.2.10 Sacramento River Site River Mile 47.9 R

Sacramento River Site River Mile 47.9 R (SAC47.9R) is located on the right bank of the Sacramento River, in Yolo Country, California, at historical river mile 47.9. The bank protection footprint is approximately 1030 feet long, encompasses approximately 2.6 acres, and parallels and is accessed from River Road. The construction easement is approximately 1200 feet long and encompasses approximately 4.2 acres. Waypoints that describe the footprint of the bank protection site and the construction footprint are listed in Table 10. Access to the Site was limited in places by the steep bank and dense vegetation.

Table 10. Approximate Limits of SAC47.9R

Bank Protection Footprint		Construction Footprint	
Northing	**Easting**	**Northing**	**Easting**
38.473094º	-121.516591º	38.473056º	-121.516260º
38.473636º	-121.516414º	38.473897º	-121.515957º
38.473332º	-121.520483º	38.473331º	-121.520483º
38.73927º	-121.570363º	38.474169º	-121.520334º

The properties in the immediate vicinity of the Site are located on the south side of River Road and are agricultural or developed for residential use. Properties directly across River Road from the Site include four private homes and agricultural fields.

2.2.11 Sacramento River Site River Mile 48.2 R

Sacramento River Site River Mile 48.2 R (SAC48.2R) is located on the right bank of the Sacramento River, in Yolo Country, California, at historical river mile 48.2. The bank protection footprint is approximately 1040 feet long, encompasses approximately 2.6 acres, and parallels and is accessed from River Road. The construction easement is approximately 1200 feet long and encompasses approximately 4.2 acres. Waypoints that describe the footprint of the bank protection site and the construction footprint are listed in Table 11. Access to the Site was limited in places by the steep bank and dense vegetation.

Table 11. Approximate Limits of SAC48.2R

Bank Protection Footprint		Construction Footprint	
Northing	**Easting**	**Northing**	**Easting**
38.473189º	-121.524328º	38.473148º	-121.524720º
38.473723º	-121.524270º	38.473921º	-121.524682º
38.473332º	-121.520483º	38.473331º	-121.520483º
38.73927º	-121.570363º	38.474169º	-121.520334º

The properties in the immediate vicinity of the Site are located on the south side of River Road and are agricultural or developed for residential use. Properties directly across River Road from the Site include four private homes and agricultural fields.

2.2.12 Sacramento River Site River Mile 62.5 R

Sacramento River Site River Mile 62.5 R (SAC62.5R) is located on the right bank of the Sacramento River, within the town of West Sacramento in Yolo Country, California, at historical river mile 62.5. The bank protection footprint is approximately 255 feet long, encompasses approximately 1.2 acres, and parallels and is accessed from North Harbor Boulevard. The construction easement is approximately 400 feet long and encompasses 3.5 acres. Waypoints that describe the footprint of the bank protection site and the construction footprint are listed in Table 12. Access to the Site was limited in places by the steep bank and dense vegetation.

Table 12. Approximate limits of SAC62.5R

Bank Protection Footprint		**Construction Footprint**	
Northing	**Easting**	**Northing**	**Easting**
38.597223º	-121.548315º	38.597214º	-121.548711º
38.597689º	-121.548003º	38.598058º	-121.548162º
38.596973º	-121.547570º	38.596784º	-121.547245º
38.597542º	-121.547409º	38.597720º	-121.546952º

The properties in the immediate vicinity of the Site are located on the south side of North Harbor Boulevard and are undeveloped or developed for commercial and residential use. The property directly across North Harbor Boulevard from the Site is undeveloped.

2.2.13 Sacramento River Site River Mile 68.9 L

Sacramento River Site River Mile 68.9 L (SAC68.9L) is located on the left bank of the Sacramento River, in Sacramento Country, California, at historical river mile 68.9. The bank protection footprint is approximately 785 feet long, encompasses approximately 4.56 acres, and parallels and is accessed from Garden Highway. The construction easement is approximately 1000 feet long and encompasses approximately 7.4 acres. Waypoints that describe the footprint of the bank protection site and the construction footprint are listed in Table 13. Access to the south end of the Site was limited by the presence of a backhoe performing tree and shrub trimming activities. Access to the Site was also limited in places by the steep bank and dense vegetation.

Table 13. Approximate Limits of SAC68.9L

Bank Protection Footprint		**Construction Footprint**	
Northing	**Easting**	**Northing**	**Easting**
38.655998º	-121.602656º	38.655731º	-121.602399º
38.655532º	-121.603439º	38.655131º	-121.603404º
38.657789º	-121.604187º	38.658021º	-121.604351º
38.657341º	-121.604975º	38.657316º	-121.605313º

The properties in the immediate vicinity of the Site are located on the east side of Garden Highway and are agricultural or developed for residential use. Properties directly across Garden Highway from the Site include two agricultural fields.

2.2.14 Sacramento River Site River Mile 78.0 L

Sacramento River Site River Mile 78.0 L (SAC78.0L) is located on the left bank of the Sacramento River, in Sutter Country, California, at historical river mile 78.0. The bank protection footprint is approximately 1060 feet long, encompasses approximately 5.4 acres, and parallels and is accessed from Garden Highway. The construction easement is approximately 1250 feet long and encompasses approximately 5.4 acres. Waypoints that describe the footprint of the bank protection site and the construction footprint are listed in Table 14. Access to the Site was limited in places by the steep bank and dense vegetation.

Table 14. Approximate Limits of SAC78.0L

Bank Protection Footprint		Construction Footprint	
Northing	**Easting**	**Northing**	**Easting**
38.768262º	-121.594455º	38.768071º	-121.594095º
38.768131º	-121.595269º	38.767727º	-121.595404º
38.770856º	-121.596105º	38.771159º	-121.596122º
38.770706º	-121.596875º	38.770873º	-121.597450º

The properties in the immediate vicinity of the Site are located on the east side of Garden Highway and are agricultural or developed for residential use. Properties directly across Garden Highway from the Site include agricultural fields.

2.3 STANDARD ENVIRONMENTAL RECORD SOURCES, FEDERAL AND STATE

The purpose of records review is to obtain and review records that help identify RECs in connection with the Site and surrounding vicinity.

MEC^{X} reviewed available regulatory information to evaluate potential environmental concerns on and near the Site. A state and federal database search was conducted by Environmental Data Resources, Inc. (EDR) for MEC^{X}. The EDR reports dated November 7, 2006 are presented in Appendices A-N. The databases reviewed and search distances used are specifically listed in the EDR reports. MEC^{X} reviewed the report, and assessed the likelihood that any identified facilities may result in a recognized environmental condition in connection with the Site. The specific databases that were searched are listed in the EDR report in Appendix A.

2.3.1 SAC16.9L

Leaking underground storage tanks (USTs), contaminated or potentially contaminated sites, and businesses with hazardous materials on site were identified as being within one mile of the site. Closed sites, businesses with hazardous materials with no violations, and sites identified as located downstream or at lower elevations were considered to have no potential impact on the Site. Eliminating these sites left two sites: Isleton Cleaners, from the EnviroStor database and Isleton General Store, a leaking UST site listed in the EDR “Orphan Summary.” The Orphan Summary lists potential contamination sites for which specific locations are not available from the databases searched. In cases where exact locations cannot be determined, the potential impact on the site cannot be assessed.

The EDR report for this Site can be found in Appendix A.

2.3.1.1 Isleton Cleaners

The EnviroStor database lists both contaminated sites and potentially contaminated sites. Isleton Cleaners was located at 10 Main Street in Isleton, approximately 3000 feet east of SAC16.9L. This business is no longer operating, had no reported violations, and was listed as a historical site with no specified contamination.

2.3.1.2 Isleton General Store

A search of the California Geotracker LUFT Site indicated that the Isleton General Store is currently operated by Dunn and Son Dodge Dealership (Dunn). The Dunn site located at 208 2nd Street in Isleton, approximately 1700 feet east of SAC16.9L.

A leaking gasoline UST was discovered at Dunn in 1987. No regulatory enforcement actions were taken and according to the LUFT program, some remediation was performed in 1990. The site came under regulatory review again in 2002. In September 2006, an environmental contractor, EarthTec, filed a remediation pilot study work plan and two quarterly groundwater monitoring reports. Maps provided in the work plan show the contamination from Dunn moving westward, toward the Site. The maps also show one monitoring well (MW6) installed one block west of the Dunn site, between the plume and SAC16.9L, and two monitoring wells (MW2 and MW4) installed one block north of the Dunn site, between the plume and the Sacramento River. From 1994 to June 2006, about 30 quarterly monitoring samples have been collected from these wells. MW6 has had two detects for total petroleum hydrocarbons (TPH). The most recent detect was in June 2005 at a concentration of 63 parts-per-billion (ppb). MW2 has had sporadic detects for TPH, benzene, toluene, ethyl benzene, and total xylene. The most recent detect was in June 2005 for TPH only, at 84 ppb. MW4 has had two detects, one for TPH and one for toluene. The most recent detect was in December 2003 for TPH at 81 ppb.

2.3.2 STE19.0R

EDR reported no mapped sites from the search of available government records. The specific databases that were searched are listed in the EDR report in Appendix B.

2.3.3 STE19.4R

EDR reported no mapped sites from the search of available government records. The specific databases that were searched are listed in the EDR report in Appendix C.

2.3.4 STE22.7R

A single site, a business with hazardous materials on site, was identified as being within one mile of the STE22.7R. As this business is downstream of the Site, it has no potential impact on the Site.

The EDR report for STE22.7R site can be found in Appendix D.

2.3.5 SAC33.0R

EDR reported no mapped sites from the search of available government records; however, the site mapped for SAC33.3R could affect SAC33.0R as it is purportedly within one mile of SAC33.0R. This site, Delta Aerial Applicators, is an open case identified from the State Water Resources Control Board Spills, Leaks, Investigations, and Cleanups (SLIC) program. The Central Valley RWQCB contact for the site, Cori Condon, indicated that site inspections were conducted at the Delta Aerial Applicator property at 15931 Sutter Island Road in October 1985 and October 1987. The inspection reports note that the property has been used as a base for aerial pesticide, fertilizer, and seed application activities since the mid 1960s. After application, tanks and planes were rinsed on a paved area and the rinse water was allowed to drain to an earthen ditch. In the October 1987 report, the investigator noted that it was possible to see the path the rinse water followed in the ditch, up to the point it soaked into the ground, and at this spot the investigator noted there were six dead pear trees. There has been no further investigation of this site by the RWQCB since 1987.

Other available information, however, does not support Delta Aerial Applicators as being located at 15931 Sutter Island Road. First, the historical aerial photographs (see section 2.3.5) of the area identified as the location of Delta Aerial Applicators do not reveal an airfield. Additionally, the RWQCB Geotracker database maps the Delta Aerial Applicators site on the other side of the Sacramento River, but then lists this location under another facility name, JR Simplot. Investigation of the JR Simplot facility finds that it was not at this location. The RWQCB was contacted for clarification regarding the location of Delta Aerial Applicators. When contacted the second time, Cori Condon found a map indicating the location of Delta Aerial Applicators. According to this map, the facility is located on Grand Island Road, instead of Sutter Island Road, placing the facility approximately one-half mile downstream of SAC33.0R. Only the historical aerial photographs from 1993 and 1998 show Grand Island Road; however, both photographs show a strip of land that could be an airfield. Based on the absence of an airfield on Sutter Island Road and the possible presence of an airfield on Grand Island Road, MEC^{X} believes that the location of Delta Aerial Applicators is probably on Grand Island Road. As the site is actually located downstream of SAC33.0R, there is no potential impact.

The Orphan Summary identified leaking underground storage tanks (USTs), historical USTs, contaminated sites, and businesses with hazardous materials on site were as being within one mile of SAC33.0R. Closed sites, businesses with hazardous materials with no violations, and sites identified as located downstream or at lower elevations were considered to have no potential impact on the Site. Eliminating these sites left three sites for which exact locations could not be determined. Two of these sites, Rueben Gentner and JH Thomas, were from the SWEEPS UST and/or the HIST UST databases, both of which list USTs and do not necessarily indicate contaminated sites. A search of the California Geotracker LUFT site did not identify any leaking USTs associated with these sites. The third site, Homackich and Mello, was identified as a business with hazardous materials on site. A search of the County of Sacramento Environmental Management Department's *Master List of Facilities* and *Toxic Site Clean-Up* did not identify this site. As no releases appear to be associated with these three sites, there is no potential impact on SAC33.0R.

The EDR report for SAC33.0R can be found in Appendix E.

2.3.6 SAC33.3R

One site, Delta Aerial Applicators, was identified as being within one mile of the Site. The specifics of this site are discussed above in Section 2.3.5. Additionally, the Orphan Summary sites identified for SAC33.0R are associated with SAC33.3R; however, as no releases appear to be associated with these sites, there is no potential impact on SAC33.3R.

The EDR report for SAC33.0R can be found in Appendix F.

2.3.7 SAC43.7R

One site was identified as being with one mile of SAC43.7R; however, as this site was determined to be on the opposite side of the Sacramento River, there is no potential impact on SAC43.7R.

Sites were also identified from the Orphan Summary. Closed sites, businesses with hazardous materials with no violations, and sites identified as located downstream or at lower elevations were considered to have no potential impact on the Site. Eliminating these sites left three sites for which exact locations could not be determined. Two of these sites, Shorter's Corner and Garter Ranch, were from the UST or HIST UST databases, both of which list USTs and do not necessarily indicate contaminated sites. A search of the California Geotracker LUFT site did not identify any leaking USTs associated with these sites; therefore, there is no potential impact on SAC43.7R. The third site, a power generation plant, was identified from the California Emissions Inventory Data. No emission violations for this plant were identified.

The EDR report for SAC43.7R can be found in Appendix G.

2.3.8 SAC44.7R

Historical USTs, contaminated sites, and businesses with hazardous materials on site were identified as being within one mile of SAC44.7R. Closed sites, businesses with no violations, and sites identified as located downstream, on the other side of the river, or at lower elevations were considered to have no potential impact on SAC44.7R. All mapped sites were eliminated.

Additionally, the Orphan Summary sites identified for SAC44.7R are also associated with SAC43.7R; however, as no releases appear to be associated with these sites, there is no potential impact on SAC44.7R.

The EDR report for SAC44.7R can be found in Appendix H.

2.3.9 SAC47.0L

Leaking USTs, historical USTs, contaminated sites, and businesses with hazardous materials on site were identified as being within one mile of SAC47.0R. Closed sites, businesses with no violations, and sites identified as located downstream, on the other side of the river, or at lower elevations were considered to have no potential impact on SAC47.0R. All mapped sites were eliminated.

Additionally, the Orphan Summary sites identified for SAC47.0R are also associated with SAC43.7R; however, as no releases appear to be associated with these sites, there is no potential impact on SAC47.0R.

The EDR report for SAC47.0R can be found in Appendix I.

2.3.10 SAC47.9R

Leaking USTs, historical USTs, contaminated sites, and businesses with hazardous materials on site were identified as being within one mile of either SAC47.9 or SAC48.2R. Closed sites, businesses with hazardous materials with no violations, and sites identified as located downstream, on the other side of the river, or at lower elevations were considered to have no potential impact on SAC47.9R. All mapped sites were eliminated.

Additionally, the Orphan Summary sites identified for SAC47.9R are also associated with SAC43.7R; however, as no releases appear to be associated with these sites, there is no potential impact on SAC47.9R.

The EDR report for SAC47.9R can be found in Appendix J.

2.3.11 SAC48.2R

Leaking USTs, historical USTs, contaminated sites, and businesses with hazardous materials on site were identified as being within one mile of either SAC47.9R or SAC48.2R. Closed sites, businesses with hazardous materials with no violations, and sites identified as located downstream, on the other side of the river, or at lower elevations were considered to have no potential impact on SAC48.2R. All mapped sites were eliminated.

Additionally, the Orphan Summary sites identified for SAC48.2R are also associated with SAC43.7R; however, as no releases appear to be associated with these sites, there is no potential impact on SAC48.2R.

The EDR report for SAC48.2R can be found in Appendix K.

2.3.12 SAC62.5R

Leaking USTs, Historical USTs, contaminated sites, and businesses with hazardous materials on site were identified as being within one mile of SAC62.5R. Closed sites, businesses with hazardous materials with no violations, and sites identified as located downstream, on the other side of the river, or at lower elevations were considered to have no potential impact on SAC62.5R. After eliminating these sites, three mapped sites remained.

The EDR report for SAC62.5R can be found in Appendix L.

2.3.12.1 Riverpoint Business Park

This site, located at the intersection of Harbor Boulevard and Reed Avenue is, at its closest, approximately 600 feet south of SAC62.5R. Formerly the site was occupied by a battery recycling company. Lead from the used batteries has impacted soils at the site. According to the RWQCB contact for the site, Duncan Austin, although only some of the lead has been stabilized in concrete, there will be no further remedial investigations or remediation at the site. The contaminated area has been capped with asphalt and the property will be placed under a deed restriction. Per the deed restriction, the asphalt cap will be inspected yearly to assure proper water drainage.

2.3.12.2 Home Depot

This site, located at 700 Riverpoint Circle is, at its closest, approximately 1900 feet south of SAC62.5R. During a remedial investigation, high levels of arsenic contamination were found in the soils of the site. This contamination is from historical use of arsenic containing pesticides when the site was a pear orchard. According to the RWQCB contact for the site, Duncan Austin, there will be no further remedial investigations or remediation at the site. The contaminated area has been capped with asphalt and the property will be placed under a deed restriction. Per the deed restriction, the asphalt cap will be inspected yearly to assure proper water drainage.

2.3.12.3 Petroleum Tank Line

This site, located at 2600 Rice Avenue is, at its closest, approximately 4000 feet south-southeast of SAC62.5R. Four USTs were removed from three separate sites at the Petroleum Tank Line Facility in 1995. Soil beneath two tanks was discovered to be contaminated with diesel fuel or diesel and gasoline. Some of the contaminated soils have been excavated and stockpiled on-site. An environmental firm, Ramcon, performed an initial site investigation in February of 2005. This investigation determined that both soil and groundwater were impacted by diesel and volatile organic constituents. According to a quarterly monitoring report filed by Ramcon in November 2005, there are five monitoring wells installed at the facility; however, none are between the facility and SAC62.5R and none are proposed. According to the RWQCB contact, David Stavarek, recent quarterly sampling indicates that groundwater at the facility is flowing to the northwest at three monitoring wells (toward SAC62.5R) and to the northeast at one well. Current levels of contamination range from 830 ppb for 1,1-dichloroethene, to 35 ppb for tetrachloroethene, to less than 10 ppb for the rest of the monitored constituents. Additional work is pending for this site.

2.3.13 SAC68.9L

Historical USTs and businesses with hazardous materials on site were identified as being within one mile of the site. Closed sites, businesses with hazardous materials with no violations, and sites identified as located downstream or at lower elevations were considered to have no potential impact on the Site. All mapped sites were eliminated.

One site from the Orphan Summary was identified. The site, JR McCray Plastering, was from the UST databases, which lists USTs and does not necessarily indicate a contaminated site. A search of the California Geotracker LUFT site did not identify any leaking USTs associated with this site; therefore, there is no potential impact on SAC68.9L.

The EDR report for SAC68.9L can be found in Appendix M.

2.3.14 SAC78.0L

EDR reported no mapped sites from the search of available government records and no sites from the Orphans Summary were identified. The EDR report for SAC78.0L can be found in Appendix N.

2.4 HISTORICAL USE INFORMATION ON THE SITE AND ADJOINING PROPERTIES

MEC^X reviewed the previous use of properties surrounding the Sites by reviewing aerial photographs and topographic maps.

The objective of the aerial photography and topographic map review was to identify past activity that could suggest hazardous substances use, storage, or disposal at the Sites, including industrial activities, open-pit dumping, tank or drum storage and disposal. These activities and associated objects can be identified by a combination of visual characteristics (i.e., size, shape, tone, shadow, and pattern).

2.4.1 SAC16.9L

MEC^X reviewed historical black and white aerial photographs that were obtained from EDR for the years 1957, 1968, 1971, 1984, 1993 and 1998. The aerial photographs are presented in the EDR report in Appendix A.

Although data gaps exist, based on the reasonably ascertainable information reviewed, it appears that the adjoining property use has remained consistent, primarily agricultural at the downstream end of SAC16.9L and single family residences at the upstream end. The land was developed for these residences after 1968 and most of the homes were built after 1971. The agricultural use of the adjoining property appears to have remained consistent, with no change in the amount of cultivated acreage.

No Sanborn fire insurance maps were available for the SAC16.9L.

2.4.2 STE19.0R

MEC^X reviewed historical black and white aerial photographs that were obtained from EDR for the years 1952, 1968, 1971, 1987, 1993 and 1998. The aerial photographs are presented in the EDR report in Appendix B.

Although data gaps exist, based on the reasonably ascertainable information reviewed, it appears that the adjoining property use has remained primarily agricultural, with one single family residence. A large barn was built on the property between 1952 and 1968, but there has been no change in the amount of cultivated land

No Sanborn fire insurance maps were available for STE19.0R.

2.4.3 STE19.4R

MEC^X reviewed historical black and white aerial photographs that were obtained from EDR for the years 1952, 1968, 1971, 1987, 1993 and 1998. The aerial photographs are presented in the EDR report in Appendix C.

Although data gaps exist, based on the reasonably ascertainable information reviewed, it appears that the adjoining property use has remained agricultural, with a single family residence just beyond the upstream end of the Site.

No Sanborn fire insurance maps were available for STE19.4R.

2.4.4 STE22.7R

MEC^X reviewed historical black and white aerial photographs that were obtained from EDR for the years 1952, 1968, 1971, 1981, 1993 and 1998. The aerial photographs are presented in the EDR report in Appendix D.

Although data gaps exist, based on the reasonably ascertainable information reviewed, it appears that the adjoining property use has remained consistently agricultural, with no increase or decrease in the amount of cultivated land. In 1952, there appeared to be one single family residence on an adjoining property. A small parcel of land near the site appears to have been sold between 1968 and 1971, and a larger home was built on this parcel between 1971 and 1981.

No Sanborn fire insurance maps were available for STE22.7R.

2.4.5 SAC33.0R

MEC^X reviewed historical black and white aerial photographs that were obtained from EDR for the years 1952, 1993 and 1998. Aerial photographs were provided for 1968, 1971 and 1981; however, these photographs do not depict all of SAC33.0R. The aerial photographs are presented in the EDR report in Appendix E.

Although data gaps exist, based on the reasonably ascertainable information reviewed, it appears that the adjoining property use has remained agricultural in nature, with two associated single family residences. It appears that additional acreage west of SAC33.0R was cultivated between 1981 and 1993.

No Sanborn fire insurance maps were available for SAC33.0R.

2.4.6 SAC33.3R

MEC^X reviewed historical black and white aerial photographs that were obtained from EDR for the years 1952, 1968, 1971, 1981, 1993 and 1998. The aerial photographs are presented in the EDR report in Appendix F.

Although data gaps exist, based on the reasonably ascertainable information reviewed, it appears that the adjoining property use has remained consistent, primarily agricultural with one single family residence and the western terminus of the Highway 160 drawbridge. The amount of cultivated land on an adjoining property decreased slightly between 1952 and 1968 and then increased between 1981 and 1993, to a level greater than seen in 1952.

No Sanborn fire insurance maps were available for SAC33.3R.

2.4.7 SAC43.7R

MEC^X reviewed historical black and white aerial photographs that were obtained from EDR for the years 1952, 1961, 1971, 1981, 1993 and 1998. The aerial photographs are presented in the EDR report in Appendix G.

Although data gaps exist, based on the reasonably ascertainable information reviewed, it appears that the adjoining property use has remained primarily agricultural, with no increase or decrease in the amount of cultivated land. Several single family residences were apparent in 1952 and one was added at approximately mid-site between 1971 and 1981.

No Sanborn fire insurance maps were available for SAC43.7R.

2.4.8 SAC44.7R

MEC^X reviewed historical black and white aerial photographs that were obtained from EDR for the years 1952, 1961, 1971, 1981, 1993 and 1998. The aerial photographs are presented in the EDR report in Appendix H.

Although data gaps exist, based on the reasonably ascertainable information reviewed, it appears that the adjoining property use has remained primarily agricultural, with no increase or decrease in the number of single family residences or the amount of cultivated land.

No Sanborn fire insurance maps were available for the SAC44.7R.

2.4.9 SAC47.0L

MEC^X reviewed historical black and white aerial photographs that were obtained from EDR for the years 1952, 1961, 1971, 1981, 1993 and 1998. The aerial photographs are presented in the EDR report in Appendix I.

Although data gaps exist, based on the reasonably ascertainable information reviewed, it appears that the adjoining property use has changed from agricultural to commercial, recreational and public works. In 1952 all of the adjoining property was agricultural with one single family residence. Between 1952 and 1961 a drinking water treatment plant was built at the north end of SAC47.0L and a storm water runoff ditch was built near the south end of the SAC47.0L. The drinking water treatment plant expanded between 1961 and 1971, and a small parcel of land south of the plant appears to have been used for materials storage. The single family residence was removed between 1971 and 1981. An office building was built on the property adjoining the southern end of SAC47.0L between 1981 and 1993 and athletic fields were build on the property north of the office building between 1993 and 1998.

No Sanborn fire insurance maps were available for the SAC47.0L.

2.4.10 SAC47.9R

MEC^X reviewed historical black and white aerial photographs that were obtained from EDR for the years 1952, 1961, 1971, 1981, 1993 and 1998. The aerial photographs are presented in the EDR report in Appendix J.

Although data gaps exist, based on the reasonably ascertainable information reviewed, it appears that the adjoining property use has remained primarily agricultural, with no increase or decrease in the number of single family residences or the amount of cultivated land.

No Sanborn fire insurance maps were available for the SAC47.9R.

2.4.11 SAC48.2R

MEC^X reviewed historical black and white aerial photographs that were obtained from EDR for the years 1952, 1961, 1971, 1981, 1993 and 1998. The aerial photographs are presented in the EDR report in Appendix K.

Although data gaps exist, based on the reasonably ascertainable information reviewed, it appears that the adjoining property use has remained primarily agricultural, with no increase or decrease in the number of single family residences or the amount of cultivated land.

No Sanborn fire insurance maps were available for the SAC48.2R.

2.4.12 SAC62.5R

MEC^X reviewed historical black and white aerial photographs that were obtained from EDR for the years 1952, 1961, 1971, 1981, 1993 and 1998. The aerial photographs are presented in the EDR report in Appendix L.

Although data gaps exist, based on the reasonably ascertainable information reviewed, it appears that the adjoining property use has changed from agricultural to commercial. Prior to 1981 properties directly adjoining SAC62.5R were agricultural, as were properties to the west. Properties to the east were single family residences. Interstate 80, the northbound lanes of which are in SAC62.5R, was built in 1971. Most of the commercial development of the adjoining properties occurred between 1981 and 1993; although a significant amount of property to the west of SAC62.5R was developed between 1993 and 1998.

No Sanborn fire insurance maps were available for the SAC62.5R.

2.4.13 SAC68.9L

MEC^X reviewed historical black and white aerial photographs that were obtained from EDR for the years 1952, 1961, 1971, 1981, 1993 and 1999. The aerial photographs are presented in the EDR report in Appendix M.

Although data gaps exist, based on the reasonably ascertainable information reviewed, it appears that the adjoining property use has remained primarily agricultural, with no increase or decrease in the amount of cultivated land.

No Sanborn fire insurance maps were available for the SAC68.9L.

2.4.14 SAC78.0L

MEC^X reviewed historical black and white aerial photographs that were obtained from EDR for the years 1952, 1961, 1972, 1987, 1993 and 1998. The aerial photographs are presented in the EDR report in Appendix N.

Although data gaps exist, based on the reasonably ascertainable information reviewed, it appears that the adjoining property use has remained consistently agricultural, with no increase or decrease in the amount of cultivated land.

No Sanborn fire insurance maps were available for SAC78.0L.

2.5 INFORMATION FROM SITE RECONNAISSANCE

MEC^X's representative, Dr. Patti Meeks, performed visual inspections at the Sites on November 6-10, 2006.

MEC^X inspected the Sites for evidence of HTRW. MEC^X also inspected the Sites for evidence of a release or threat of release of hazardous materials to the environment on or in the vicinity of the Sites. Such evidence may include oil and grease staining, stressed and/or dying vegetation, UST vent/fill pipes, dumping activities, noxious odors, and/or storage of hazardous substances.

2.5.1 SAC16.9L

Access to the Site was limited in places by steep banks and dense vegetation and direct visualization of the ground was additionally limited by heavy leaf litter. Where direct access was not possible, the area was viewed from above or below. Where access was possible, no direct evidence of the presence or possible presence of HTRW was observed. The site appears to be used for fishing, as a small platform built on two pallets was found near the water. Trash and other evidence of human occupation was noted along the length of the site.

A gas station with large aboveground fuel storage tanks is in operation about 1100 feet upstream of SAC16.9L.

2.5.2 STE19.0R

Access to the Site was in places limited by steep banks and dense vegetation and direct visualization of the ground was additionally limited by heavy leaf litter. Where direct access was not possible, the area was viewed from above or below. Where access was possible, no direct evidence of the presence or possible presence of HTRW was observed.

2.5.3 STE19.4R

Access to the Site waterline was limited dense vegetation. Where direct access was not possible, the area was viewed from above or below. The upper banks of the site are lightly vegetated and appear to have been part of a controlled burn to control growth. Where access was possible, no direct evidence of the presence or possible presence of HTRW was observed.

2.5.4 STE22.7R

Access to the Site was limited by steep banks and dense vegetation. Where direct access was not possible, the area was viewed from above or below. Where access was possible, no direct evidence of the presence or possible presence of HTRW was observed.

2.5.5 SAC33.0R

Access to the Site was limited by dense vegetation and direct visualization of the ground was additionally limited by heavy leaf litter. Where direct access was not possible, the area was viewed from above or below. The site appears to be used for fishing, as fishing related trash and other evidence of human occupation was at waterline. Where access was possible, no direct evidence of the presence or possible presence of HTRW was observed.

2.5.6 SAC33.3R

Access to the Site was limited by dense vegetation and direct visualization of the ground was additionally limited by heavy leaf litter. Where direct access was not possible, the area was viewed from above or below. The primary formation of the site is the western terminus of the Highway 160 drawbridge, at the southern end of the site within the construction footprint. Where access was possible, no direct evidence of the presence or possible presence of HTRW was observed.

2.5.7 SAC43.7R

Access to the Site was limited in places by dense vegetation and direct visualization of the ground was additionally limited by heavy leaf litter. Where direct access was not possible, the area was viewed from above or below. The site has collected significant amount of trash, from paper and plastics to empty five-gallon buckets and tires. Despite the significant amount of detritus, where access was possible, no direct evidence of the presence or possible presence of HTRW was observed.

2.5.8 SAC44.7R

Access to the Site was limited by steep bank, some dense vegetation and slash piles. Additionally, direct visualization of the ground was limited in places by heavy leaf litter. Where direct access was not possible, the area was viewed from above or below. Where access was possible, no direct evidence of the presence or possible presence of HTRW was observed.

2.5.9 SAC47.0L

Access to the Site was limited in places by dense vegetation and storm water outfalls. Additionally, direct visualization of the ground was limited in places by heavy leaf litter. Where direct access was not possible, the area was viewed from above or below. Where access was possible, no direct evidence of the presence or possible presence of HTRW was observed.

At the north end of the Site are two sets of pipes through which the city of Sacramento pumps storm water runoff into the river. The associated pumping station is located on the opposite side of Freeport Boulevard, near the southern end of the Site. These pumps were not in operation at the time of the site visit. The area designated for Site parking is currently occupied by stacks of railroad ties, some of which are in direct contact with the ground, rusting 50-gallon drums containing railroad tie spikes, and a large pile of roadbed gravel. This area is covered with gravel and no staining or signs of leakage were visible on the gravel. At the time of the site visit a backhoe was loading gravel into a truck. Where it was possible to visualize the ground, no direct evidence of the presence or possible presence of HTRW was observed in the designated parking area.

2.5.10 SAC47.9R

Access to the Site was limited in places by the steep bank, dense vegetation and some deadfall. Where direct access was not possible, the area was viewed from above or below. Additionally, direct visualization of the ground was limited in places by heavy leaf litter. Discarded tires were noted in the water and the remnants of an auto body were noted on the bank. Vegetation near the tires and auto remnants showed no signs of distress nor were there any signs of leakage from the auto. Also in the water, were a few, telephone pole-sized supports that perhaps served as a mooring. Where access was possible, no direct evidence of the presence or possible presence of HTRW was observed.

2.5.11 SAC48.2R

Access to the Site was limited by in places dense vegetation and direct visualization of the ground was limited in places by heavy leaf litter. Where direct access was not possible, the area was viewed from above or below. Signs of a fire were noted on some trees, both standing and fallen. An aluminum dock built on wooden supports, the remnants of two auto bodies, full bags of trash, and bags of cement mix were noted along the bank. A compressed gas tank, tires, and large metal pipe were noted in the water. Vegetation near these items showed no signs of distress nor were there any signs of leakage from the auto. The intake pipes for local irrigating were also noted on the bank. Where access was possible, no direct evidence of the presence or possible presence of HTRW was observed.

2.5.12 SAC62.5R

Access to the Site was limited in places by dense vegetation and direct visualization was limited in places by heavy leaf litter. Where direct access was not possible, the area was viewed from above or below. Some trash, including rusty pipe was noted along the bank. On the north side of the parking area, along the land side of the levee, several old creosote timbers were found to be jutting out of the ground where the bank was collapsing. There was no vegetation near the timbers and no soil staining was noted in the bare soil. Where access was possible, no direct evidence of the presence or possible presence of HTRW was observed.

2.5.13 SAC68.9L

Access to the southern end of the Site was severely limited by a backhoe performing tree and shrub trimming activities. Trees and shrubs had the southern end had already been trimmed, and the ground was covered with the resulting slash and mulch. A slash piles also blocked the only access route to the waterline. Access to the rest of the Site was limited by steep banks, dense vegetation, and direct visualization was limited in places by heavy leaf litter. Where direct access was not possible, the area was viewed from above or below. Where access was possible, no direct evidence of the presence or possible presence of HTRW was observed.

2.5.14 SAC78.0L

Access to the Site was limited in places by dense vegetation and direct visualization was limited in places by heavy leaf litter. Where direct access was not possible, the area was viewed from above or below. Some trash was noted on the banks and in the water. Where access was possible, no direct evidence of the presence or possible presence of HTRW was observed.

2.6 CONSTRUCTION MATERIALS

Fuels, lubricants and other construction materials will enter the Sites during this project. To mitigate the possibility that fuels and lubricants used on-site may impact the environment, all construction employees must be trained in the proper use and handling of these materials. Also, an appropriate storage area must be identified for these materials. This area should have a secondary containment system such that any spills would be completely contained or stopped and mitigated prior to release to the river. A spill response plan must also be in place prior to the start of the project and all employees working on the project must receive appropriate training on this plan.

Construction materials, such as riprap, wood for habitat, and fill dirt, may be added to the levee system. These materials must be free of HTRW. To mitigate the possibility that HTRW is released to the environment through these materials, the supplying contractor should have strict specifications for these materials and the supplier providing these materials should supply certificates indicating these materials are free of HTRW.

3.0 SUMMARY OF FINDINGS, OPINIONS, AND CONCLUSIONS

This HTRW assessment has revealed no RECs in connection with the Sites, except for that described below.

- **Remedial Investigation Near SAC16.9L** – Currently a remedial investigation is occurring for a leaking gasoline UST discovered at a site (Dunn) south of SAC16.9L. Total petroleum hydrocarbons and volatile organic constituents have been detected in the Dunn site monitoring wells and data from the investigation indicate that the contamination is migrating west, toward SAC16.9L.

  A subsurface investigation would be necessary to determine if soils or sediments at SAC16.9L have been adversely affected. If soils are to be disturbed during construction, such an investigation may be warranted, especially if evidence of staining is discovered or petroleum odors are noted. (Additionally, if petroleum odors are noted, the applicable sections of the site health and safety plan should be implemented.) Soil samples from the areas that are to be disturbed should be sent to a laboratory certified by the State of California for volatile organic constituents and total petroleum hydrocarbon analyses. If the analytical results indicate the soils have not been affected by environmental practices at these facilities, then they may be reused at the site or sent for off-site disposal. If the analytical results indicate that the soils have been affected, they must not be reused at the site and, instead, should be disposed of appropriately.

- **Potential Contamination Near SAC47.0L** - Historical aerial photographs indicate that the area designated for SAC47.0L site parking has been used for material storage since at least 1971. At the time of the site reconnaissance, old creosote railroad ties and open, rusting drums containing railroad spikes were stored in this area. Depending on the nature of materials stored in this area and the storage practices, soils under the parking area may be impacted with unknown contaminants which may have migrated to the soils and sediments of SAC47.0L.

- **Remedial Investigations Near SAC62.5R** – Three facilities near SAC62.5R are currently undergoing remedial investigations or are likely to undergo remedial investigations. The Petroleum Tank Line, located about 400 feet south of SAC62.5R, is the furthest from SAC62.5R. This site is impacted by diesel and volatile organic constituent contamination. Groundwater flow data available from this site indicate that the contamination could potentially move toward SAC62.5R. The other two sites, Home Depot and the Riverpoint Business Park, are also south of SAC62.5R. Soils at the Home Depot site are impacted by arsenic from the historical use of arsenic-containing pesticides. Soils at Riverpoint Business Park are impacted by lead from historical practices at a former battery recycling facility. While metals are not as mobile as organic constituents, these sites are close to SAC62.5R and the contamination has been present for many years. Therefore, the contamination associated with these sites, arsenic and lead, may affect SAC62.5R.Therefore, contamination associated with these sites, arsenic and lead, respectively, may affect SAC62.5R.

  A subsurface investigation would be necessary to determine if soils or sediments at SAC62.5R have been adversely affected. If soils are to be disturbed during construction, such an investigation may be warranted, especially if evidence of staining is discovered or petroleum or solvent odors are noted. (Additionally, if petroleum or solvent odors are noted, the applicable sections of the site health and safety plan should be implemented.) Soil samples from the areas that are to be disturbed should be sent to a laboratory certified by the State of California for lead, arsenic, volatile organic constituents, and total petroleum hydrocarbon analyses. If the analytical results indicate the soils have not been affected by environmental practices at these facilities, then they may be reused at the site or sent for off-site disposal. If the analytical results indicate that the soils have been affected, they must not be reused at the site and, instead, should be disposed of appropriately.

- **Dredged Material At All Sites** – According to USACE ER 1165-2-132, Section 4(a)2, dredged material or sediments beneath navigable waters are not considered as hazardous unless they are within the boundaries of a site designated by the United States Environmental Protection Agency (USEAP) or the state for a response action under the Comprehensive Environmental Response, Compensations and Liability Act (CERCLA) or are within the boundaries of a site on the National Priorities List (NPL). The areas encompassing SAC16.9L, SAC33.0R, SAC33.3R, or SAC62.5R were not found to be listed as within a CERCLA sites or NPL sites. USACE ER 1165-2-132, however, further states that any sediments proposed for dredging must be tested and evaluated for their suitability for disposal as per the Clean Water Act (CWA) or the Marine Protection Research and Sanctuaries Act (MPRSA). Therefore, if the construction plan should require dredging at this site, sediment samples should be collected prior to dredging. The samples should be sent to a laboratory certified by the State of California for all applicable analyses. If the analytical results indicate the sediments have not been affected by environmental practices at the plant, then the sediments may be reused at the site or sent for off-site disposal. If the analytical results indicate that the sediments have been affected, the sediments must not be reused at the site and, instead, should be disposed of as hazardous waste.

Appendix I

Standard Assessment Methodology (SAM) Data and Results

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Wetted-Area Weighted Results Showing Relative Comparisons of With-Project Alternative Scenarios to Environmental Baseline

1 INTRODUCTION

This Appendix provides the background data, assumptions, analyses and assessment of habitat compensation requirements of this Project for the benefit of the following special status fish species considered by the Standardized Assessment Methodology (SAM) for the Sacramento River Bank Protection Project (SRBPP):

Chinook salmon *(Oncorhynchus tshawytscha)*	
Central Valley spring-run	ESA Threatened
Central Valley fall-run	ESA Candidate
Central Valley late fall-run	ESA Candidate
Sacramento River winter-run	ESA Endangered
Central Valley steelhead *(Oncorhynchus mykiss)*	ESA Threatened
Delta smelt *(Hypomesus transpacificus)*	ESA Threatened

1.1 Background

The SAM (USACE 2004) was developed by the Corps, in consultation with an interagency working group (IWG) that included representatives from state and federal resource agencies (CDFG, NMFS, USFWS), the California State Reclamation Board and the California Department of Water Resources. The SAM is intended to address specific habitat assessment and regulatory needs to ensure adequate habitat loss mitigation and compensation measures are adopted for ongoing and future bank protection actions in the SRBPP planning area (USACE 2004). The SAM was designed to address a number of limitations associated with previous habitat assessment approaches and provide a tool to systematically evaluate the impacts and compensation requirements of bank protection projects based on the needs of listed SPECIAL STATUS fish species, as well as those listed under the Pacific Fishery Management Council's Salmon Fishery Management Plan.

1.2 SAM Modeling Approach

In general, the SAM quantifies habitat values in terms of bank line- or area-weighted species responses that are calculated by combining indices of habitat quality (i.e., fish response indices) with quantity (bank length or wetted area) for each season, target year, and relevant species/life stage. The SAM employs six habitat variables to characterize nearshore and floodplain habitats of listed fish species:

- ***bank slope*—**average bank slope along each average seasonal water surface elevation;
- ***floodplain availability***—ratio of wetted channel and floodplain area during the 2-year flood to the wetted channel area during average winter and spring flows;

- ***bank substrate size***—the median particle diameter of the bank (i.e., D50) along each average seasonal water surface elevation;
- ***instream structure***—percent of shoreline coverage of instream woody material along each average seasonal water surface elevation;
- ***aquatic vegetation***—percent of shoreline coverage of aquatic or riparian vegetation along each average seasonal water surface elevation; and
- ***overhanging shad***e—percent of the shoreline coverage of shade along each average seasonal water surface elevation.

A major advantage of the SAM over prior assessment methodologies is that it integrates species life history (life stage occurrence by reach and month) with flow-related variability in habitat quality and availability. The SAM does not directly model changes in the above variables. Instead habitat changes are entered by the user into an input data file to an electronic calculation template (ECT) that tracks species responses to Project actions over time. Changes in habitat variables may be fixed in time, such as installation of revetment at a particular slope and substrate size. In other circumstances, habitat evolution over time may represented by more gradual changes in variables such as changes in floodplain inundation due to meander migration or changes in shade due to growth of planted vegetation. Typically, habitat evolution modeling is restricted to riparian growth models.

Once a particular time series of habitat variable estimates are developed and entered into an input file to the ECT, fish responses are calculated from previously developed relationships between habitat variables and species/life stage responses (USACE 2004). The response indices vary from 0 to 1, with 0 representing unsuitable conditions and 1 representing optimal conditions for survival, growth, and/or reproduction. For a given site and scenario (e.g., with or without Project), the SAM uses these relationships to determine the response of individual species and life stages to the measured or predicted values of each variable for each season and target year, and then multiplies these values together to generate an overall species response index. This index is then multiplied by the linear ft or area of bank to which it applies to generate a weighted species response index (expressed as ft or square ft). The species response index provides a common metric that can be used to quantify habitat values over time, compare Project alternatives to existing conditions, and evaluate the effectiveness of on-site and off-site mitigation actions.

2 HABITAT ANALYSIS

Following procedures described in the SAM (USACE 2004), planned construction activities at each site were translated into habitat variables for existing and with-Project conditions in each of four seasons using available data sources. The relevant habitat conditions to encode the conceptual response models for the focus fish species from the present to the future (t = 0, 1, 5, 15, 25, and 50 yrs), and under with-Project and without-Project conditions are described below.

2.1 Habitat Unit Assignment and Study Reach Extent

Habitat units were assigned for each study reach that extend from the channel centerline to both left and right banks up to the Project levees. The delineated units encompass the adjacent floodplain and extend along the main channel following the procedures described in the SAM Users Manual (USACE 2006). Visible bank types were delineated using a GIS implementation of the USACE riprap database (USFWS 2002, USACE 2003), which was queried directly to indicate the presence of natural or revetted banks.

2.2 Hydraulic Data Analysis

2.2.1 Water surface elevations

Average fall, winter, spring, and summer water surface elevations (seasonal shoreline elevations) for the Project sites were estimated by USACE (B. Whitin 2006, pers. comm.) using U-Net (Barkau 1992, USACE 1997) modeling from daily flow data measured in the Sacramento River at the USGS gage locations listed below for the period 1967–2005:

- RM 78.5 (USGS 11425500 at Verona)
- RM 48 (USGS 11447650 at Freeport)

Because near Delta sites are strongly affected by tidal variations, water surface slope downstream of the Freeport gage were adjusted using linear regression on the distributary flow splits using the USACE (1997) Comprehensive Study UNET model results to estimate loss of flow between Freeport and downstream sites. Seasonal water surface elevations at Delta sites (downstream of RM 30) were assumed to be the same in all but 2-year storm flow conditions (Tables I-4 through I-31).

2.2.2 Wetted areas

Wetted area estimates for each Project site (Tables I-4 through I-31) were obtained from site descriptions provided by the Corps and represent the total planform area of the Project footprint. For the purposes of determination of the Floodplain Inundation ratio (discussed below), however, GIS software was used with average shoreline elevations determined by U-Net to estimate wetted surface areas of the river (measured from the centerline of the river) to the bank-line intersection of a digital elevation model of the site topography.

2.2.3 Shoreline length

Shoreline lengths within the Project limits at each site (Tables I-4 through I-31) were defined as the total length of continuous shoreline (defined by the water's edge or corresponding contour line) corresponding to each average seasonal flow (USACE 2004). For areas away from the immediate vicinity of the Project sites, GIS software was used to estimate the wetted bank-line length at the intersection of the seasonal shoreline elevations described above. Bank lengths within the Action area of each Project site were obtained from the Ayres (2006a) SRBPP erosion inventory report. Based on the Project descriptions, no significant changes in shoreline length are expected under with-Project conditions.

2.3 Present Day and Future Habitat Variable Estimates

With habitat units for each Project site represented by its size (i.e., bank line length, wetted area), habitat variables may be estimated by a number of methods. Although initially collected to determine specific location and extent of bank revetment, a subsequent use of the riprap data (USFWS 2002) in the SAM was to establish habitat variable estimates. Tables I-4 through I-31 summarize the SAM input data that were used to characterize existing and with-Project conditions at each site. Data from the above sources are discussed further below as they are applied in the estimation of present-day and future habitat conditions in the SAM.

2.3.1 Bank slope

In the SAM, bank slope serves as an indicator of the availability of shallow-water habitat and is obtained from point estimates of bank slope (horizontal change to vertical change) along each seasonal shoreline (i.e., the line where the water surface intersects the bank on average in fall, winter, spring, and summer). For the purposes of this assessment, the bank slope extending from each seasonal shoreline to a depth of 3 ft was used to characterize shallow water habitat. For pre-Project conditions and at locations away from the immediate vicinity of the Project sites, GIS software was used with the DEM of topography at each site to estimate the bank slope corresponding to each seasonal shoreline elevation described above. Bank slope within the Action area of each Project site were obtained from preliminary design drawings (Ayres 2006b) and assumed to be 2:1 at all sites.

2.3.2 Floodplain inundation ratio

In the SAM, floodplain habitat is defined by areas that are flooded by the 2-year flood event (Q2) and measured by dividing the wetted channel and inundated floodplain areas during the 2-year flood event by the wetted channel area during average winter and spring flows. GIS software was used to estimate the wetted surface areas corresponding to each seasonal shoreline elevation described above. Using the wetted areas estimated for the 2-year recurrence interval flows (B. Whitin 2006, pers. comm.). Tables I-4 through I-31 show the floodplain inundation ratio for all sites was on the order of 1–1.2 corresponding to a narrowly confined channel between the levees. No changes in the estimated inundation ratio and habitat values under with-Project conditions were applied in the assessment.

2.3.3 Bank substrate size

Bank substrate size was measured as the median particle size (D_{50} in inches) within the submerged portion of the bank immediately below (0–3 ft) the average seasonal water surface level. For pre-Project conditions, bank-length weighted estimates of substrate size were determined from prior survey data with a value of 0.25 inch assigned to natural bank areas with fine sediment and the D50 of the dominant substrate in other bank segments dependent on practices at the time of construction. Bank substrate size within the Action area of each Project site was estimated from existing designs for similar bank protection projects. During Phase 1 of the Project (Winter 2007/07) bank substrate at all sites is assumed to be similar to pre-Project conditions. In Phase 2, from summer 2007 through Year 50 of the analysis, substrate size was assumed to average 4-inches (D_{50}) for the soil-filled rock at the summer/fall water line and 0.25 inches at the winter/spring water line.

2.3.4 Instream structure

Instream structure is defined as instream woody material (excluding live bank vegetation) that is partially or fully submerged during average seasonal flows. This variable was measured by estimating the percent of shoreline at each site that is occupied by instream woody material within the inundation zone associated with each average seasonal flow under existing and with-Project conditions. Prior visual survey estimates of the linear extent of existing instream woody material along the summer-fall and winter-spring shoreline were queried from the USACE riprap data base (USFWS 2002) to estimate bank line coverage within the Project site. Instream structure estimates within the Action area of each Project site were obtained from preliminary design drawings (Ayres 2006b) and presented in Tables I-4 through I-31. For the purposes of the assessment, initial losses in instream woody material from winter 2006/07 work (Phase 1) would be replaced following Phase 2 of the proposed Project in the fall of Year 1 of the assessment. Although the longevity of these features has not been validated through extensive monitoring, the assessment assumes the amount of instream woody material present after construction would not change significantly during the 50-year Project planning period.

2.3.5 Aquatic vegetation

Aquatic vegetation is defined as aquatic or live riparian vegetation that is partially or fully submerged during average seasonal flows. This variable was measured by estimating the percent of shoreline that is occupied by vegetation within the inundation zone associated with each average seasonal flow under existing and with-Project conditions. Measurements of the linear extent of existing vegetation along the summer-fall and winter-spring shoreline were queried from the USACE riprap data base (USFWS 2002) to estimate bank line coverage within the Project site with an assumption that submerged bank vegetation at winter and spring river stages provides a similar cover function as aquatic vegetation (USACE 2006). In addition to the planned wetland enhancements at five sites (RM 16.9L, 19.0R, 19.4R, 22.7R ,and 43.7R), similar assumptions were applied to bank revegetation plans within the Action area of each Project site obtained from preliminary design drawings (Ayres 2006b) and presented in Tables I-4 through I-31.

2.3.6 Shade

Shade was measured by estimating the percent of shoreline in which riparian vegetation extends over the water during average seasonal flows. Prior visual estimates of the linear extent of shade along the summer-fall and winter-spring shoreline were queried from the USACE riprap data base (USFWS 2002) to estimate bank line coverage within the Project site. Overhanging shade estimates within the Action area of each Project site were obtained from preliminary design drawings (Ayres 2006b) and presented in Tables I-4 through I-31. A time series of overhanging shade was estimated for the Project sites using riparian growth modeling of restricted and unrestricted plating plans (Tables I-2 and I-3) and riparian growth models presented in the SAM document (USACE 2004). Published data from floodplain restoration sites in California indicate that a reasonable survival rate after 3 years is 65 percent (Alpert et al. 1999; Morris 1993). Tree density and cover was adjusted for expected mortality due to inter-specific competition and other factors.

Based on the Project descriptions and general planting plans, it was assumed that all mature trees that currently shade the winter-spring shoreline at each site would be maintained under with-Project conditions. Initial (Year 0) shade values were conservatively estimated at 25% of existing conditions due to a combination of two factors. First, the bank fill Projects serve to shift the bank line intersection of the seasonal water surfaces towards the channel centerline and away from the existing vegetation. Second, riprap placement will remove all mid- and low-canopy shade that remains with some losses to mature trees as well. Table I-3 shows the shade evolution for the proposed planting plans on the riparian benches for the Project sites. Even with these plantings, the combined shade of existing and planted trees means that little or no riparian shade be present for several years (i.e., 3–5) following Project implementation, since it is unlikely that plantings will reach minimum canopy diameters required to achieve shading benefits of rearing juveniles along the riverbank. In the longer-term, expected increases in canopy widths of both existing trees as well as trees and shrubs planted on the constructed berms and upper slopes would eventually result in nearly 100% shading of the summer-fall shoreline (Tables I-4 though I-31).

3 BIOLOGICAL SIMULATION AND ASSESSMENT

Following the procedures outlined in the SAM Users Manual (USACE 2006), the ECT (version 2.6) was used to quantify the responses of the target fish species and life stages to with-Project conditions over a 50-year Project period relative to the species and life stage responses under without-Project (existing) conditions. As described above, modified conceptual response models were updated within the ECT and used to calculate a time series of the relative response indices for each alternative scenario developed above. Biological responses of each focus fish species life stage were predicted within each habitat unit and for each time step based on habitat variable values and fish residency determined from reach specific timing tables (USACE 2004). Based upon the locations of the proposed Project sites, the following focus fish species were considered in subsequent analyses using the species life-history timing tables developed for the SAM (USACE 2004):

- Chinook salmon
  - Central Valley spring-run
  - Central Valley fall-run
  - Central Valley late fall-run
  - Sacramento River winter-run
- Central Valley steelhead
- Delta smelt

The ECT automatically includes or excludes particular life stages of the focus fish from analysis by assessing the river mile locations of the modeled habitat units with the encoded timing tables. Although RM 20 is considered the upstream extent of the salt and freshwater mixing zone (X2) which is preferred habitat of delta smelt (USFWS 2002a), critical habitat for delta smelt extend to RM 60, just above the confluence of the American River. For this reason, the SAM assesses the potential for occurrence of delta smelt from RM 0 to 80 (USACE 2004).

3.1 Modifications to Parameters and Species Response Curve

3.1.1 Modifications of delta smelt response curves to bank cover parameters

Following a recent review and evaluation of the SAM results for delta smelt at other bank protection sites (JSA 2005) presented several recommendations to the IWG to improve the accuracy of the SAM in characterizing the habitat values for delta smelt within their designated critical habitat (RM 0–80). In particular, the results of the USACE (2004) SAM ECT (v2.5) assumed decreasing habitat values for juvenile rearing and adult life stages in response to bank cover attributes as these provide greater habitat suitability for ambush predators (USACE 2004). However, recent discussions within the IWG indicate that due to their generally pelagic life history strategy, only spawning and the earliest early larval life stages of delta smelt would be sensitive to changes in bank-line habitat attributes. Accordingly, ECT v2.5 response curves for juvenile smelt were changed in a recent (v2.6) update to the ECT to match those for spawning and adult responses were set equal to one to indicate no sensitivity to bank line cover attributes (IWM %, Aquatic Vegetation %, or Shade %).

3.1.2 Modeling and exchange of excess wood placed upstream of RM 30

Initial consultation regarding habitat features to be included in the current Project re-elevated prior concerns raised during the SAM development regarding the conflicts between beneficial effects of instream woody material for salmonids and adverse effects upon delta smelt due to increased habitat suitability for ambush predators.

USFWS representatives requested that no anchored instream woody material would be included in the Project designs downstream of RM 30, including sites RM 16.9L, 19.0R, 19.4R, and 22.7R. Because this decision constrained the ability for these sites to be constructed in a self-mitigating design for various salmonid life stages at these sites, an agreement was reached at a design review meeting on 11/16/06 to allow excess anchored wood placed at sites in Reach 1B upstream of RM 30 (including sites RM 43.7R, 44.7R, 47.0L, 47.9R, and 48.2R) to be used as an off-site mitigation for the Delta sites.

The final design implementation for sites upstream of RM 30 will include 80% bank line cover of IWM. However, SAM analyses for these sites used 40% cover because the species response curves show no further gains above 40% cover. Accordingly, the difference in actual (80%) and modeled (40%) cover was credited from the near Delta sites above RM 30 to those downstream of RM 30 (Tables I-5, I-7, I-9, and I-11) show instream woody material at a 40-percent cover.

Total bank cover of IWM at the sites above RM 30 (sites RM 33.0R, 33.3R, 43.7R, 44.7R, 47.0L, 47.9R, and 48.2R) is planned to be 80% of the site lengths or 5,170 ft. Of the 40% bank cover not accounted within the SAM analysis (2,585 ft), some 500 ft is assumed to have been applied to the 4 sites downstream of RM 30 in the SAM analysis (40% of the total length of 1,256 for sites RM 16.9L, 19.0R, 19.4R, and 22.7R). By the rationale in the above discussion, the remaining 2,085 ft will be available for use in off-site mitigation at other Project sites downstream of RM 30.

3.2 Comparisons of Relative Responses to With- and Without-Project Conditions

Assessment of the implemented actions at the Project sites requires a comparison of the with-Project scenario results discussed above to the pre-existing environmental baseline. The results represent habitat preferences of the focus fish species and their modeled responses (USACE 2004) to 1) construction modifications (e.g., riprap, rock clusters, IWM, vegetation) to the environmental baseline, and 2) longer term changes in cover values from growth of the riparian and aquatic plant communities.

Relative response comparisons are presented in Tables 32–45 and Figures 1–42 on a bank-line weighted basis, with wetted-area weighted results presented in Tables 46–59 and Figures 43–84. Cumulative relative response comparisons for sites within RM 0–

20 and 20–80 are presented in Tables 60–63. In general, positive differences between the with- and without-Project responses are assessed as a net benefit for the focus fish species (i.e., the proposed action produces superior conditions than the environmental baseline). Negative differences indicate conditions producing inferior conditions as compared to the environmental baseline and generally require additional habitat compensation.

3.3 Results Summary by Planned On-site Mitigation Features Group

The changes in habitat values to salmonids and delta smelt resulting from Project construction impacts and proposed mitigation features were modeled using the SAM. Although the analysis will be repeated during or following construction to more accurately reflect as-built conditions, results using the initial site designs indicate initial deficits in habitat for salmonids and delta smelt at many sites, followed by recovery and net positive responses for most salmonid and delta smelt life stages at most sites over the modeled 50-year period.

For the following summary of SAM model results, the 14 Project sites have been separated into three distinct groups based on the planned on-site mitigation features. A summary of those features at each Project site is in Table I-1 and the three groups are defined as follows:

- **Group 1:** Planted wetland and riparian benches and restricted planting plans (sites RM 16.9L, 19.0R, 19.4R, 22.7R, and 43.7L)
- **Group 2:** Planted riparian benches and restricted planting plans (sites RM 33.0R, 43.7R, 44.7R, 47.9R, and 48.2R)
- **Group 3:** Planted riparian benches and unrestricted planting plans (RM 47.0R, 62.5R, 68.9L, and 78.0L)

Group 1: *Five sites with planted wetland and riparian benches and restricted planting plans (sites RM 16.9L, 19.0R, 19.4R, 22.7R, and 43.7R)*

3.3.1 Salmon and steelhead

Implementation of the Project within the five sites with planted wetland and riparian benches and restricted planting plans (sites RM 16.9L, 19.0R, 19.4R and 22.7R, and 43.7R) would result in a long-term decrease of bank slope and temporary losses of aquatic and riparian vegetation and IWM along the affected shorelines. The decrease of bank slope would present a long-term benefit to juvenile and smolt salmonid life-stages. The temporary losses of aquatic and riparian vegetation and IWM would initially reduce year-round habitat value for most salmonid life stages at many sites, and would contribute to longer-term summer and fall habitat deficits for adults at most sites where they are seasonally present. These cover losses, however, would occur concurrently with construction of planted wetland and riparian benches at sites (RM 16.9L, 19.0R, 19.4R, 22.7R, and 43.7R). The constructed wetland benches are expected to increase the availability of valuable shallow-water rearing habitat for juvenile salmonids, resulting in net increases in habitat for juveniles and smolts at these sites. The typically high density of planted wetland vegetation would minimize the wetland bench area available to large predators such as largemouth bass, and predation rates in the constructed wetland habitat would therefore not be expected to exceed predation rates that normally occur in other seasonally flooded off-channel habitats where salmon and steelhead may rear.

Anchored IWM, placed on the riparian bench at site RM 43.7R and IWM credited towards the sites downstream of RM 30 (sites RM 16.9L, 19.0R, 19.4R, and 22.7R) would result in a net increase in IWM at winter and spring water levels. The modeled increase in winter and spring instream structure at these sites would contribute to wet season gains in habitat value for all species and life stages present. In summer and fall, however, anchored IWM would not be usable at the sites because IWM would be placed above the mean summer water line and would therefore not be inundated during typical summer and fall (i.e., low) flows. The loss of IWM cover during summer and fall would also result in long-term reductions in summer and fall habitat value at the site for migrating adult salmon and steelhead and for resident adult steelhead.

In winter and spring, the SAM model results indicate potential short-term habitat deficits with recovery to pre-Project conditions by Year 5, and potential long-term habitat deficits in summer and fall. Adult steelhead are particularly susceptible to reductions in summer and fall IWM due to the potential importance of instream cover for adults that may be resident or migrating upstream. The initial habitat deficit for juveniles and smolts modeled by the SAM at the five sites is driven by the loss of instream and overhead cover during Project construction. At site RM 43.7R, the addition of anchored IWM would compensate for initial winter and spring losses of juvenile, smolt, and adult habitat modeled, with net increases in winter and spring habitat for these life stages occurring no later than Year 5. At Delta sites, using the excess wood from upstream sites as design inputs to the SAM model at the Delta sites, habitat responses show a net increase in winter and spring habitat by Year 5 (site RM 16.9L, 19.4R, and 22.7R) or Year 15 (RM 19.0R). At sites RM 16.9L, 19.4R, 22.7R, and 43.7R, the nearshore habitat created by vegetated wetland benches would produce a relatively rapid positive habitat response for salmonid juveniles and smolts. This positive habitat response would be more gradual, however, at site RM 19.0R, due to a more pronounced initial loss of instream structure and subsequent slower recovery of nearshore cover for juveniles and smolts. Initial winter and spring deficits in juvenile and/or smolt habitat would be relieved by Year 5 at RM 16.9L, 19.4R, 22.7R, and 43.7R, and by Year 15 at site RM 19.0R.

In summer and fall, when IWM added would be above the mean water line and not available as habitat, the SAM model results indicate that initial juvenile and smolt habitat deficits at most sites would be gradually compensated by increasing riparian shade. SAM model results indicate immediate summer and fall habitat increases for salmonid juveniles and smolts at site RM 19.4R, and a net increase in summer and/or fall habitat for juveniles by Year 5 at sites RM 16.9L, 22.7R, and 43.7R and by Year 25 at site RM 19.0R.

A reduction in shade as a consequence of the temporary loss of riparian canopy cover would lessen the habitat value for adult salmonids due to reduced cover available for potential resting and holding habitat during upstream migration (Chinook salmon and steelhead) and residence (steelhead). However, over time the increasing shade value of planted riparian vegetation would result in eventual net increases in juvenile and smolt habitat in summer and fall at the five sites.

In summary, for adult salmon and steelhead, initial losses of summer and fall habitat for upstream migration (both species) and resident fish (steelhead) caused by reductions in available IWM would persist through Year 50 at the five sites despite gradual improvements during the modeled time period. The observed discrepancy between adult Chinook salmon and steelhead response is driven by the greater sensitivity of steelhead to reduced instream structure and overhanging shade. It is possible, however, that recovery may occur more rapidly, since the SAM model was run assuming worst-case scenarios in terms of loss of existing IWM and riparian shade values due to construction impacts (Tables I-4 through I-31). The establishment and growth of riparian vegetation on the riparian benches and emergent aquatic vegetation on the wetland benches at the five sites is expected to increase habitat values by increasing the extent of instream and overhead cover available to juvenile salmonids.

3.3.2 Delta smelt

Delta smelt may be present at any of the Project sites throughout their life cycle, especially within the five sites closest to the Delta (sites RM 16.9L, 19.0R, 19.4R, and 22.7R). Within this reach, areas downstream of RM 20 are likely to be the most used by delta smelt (Moyle 2002). Short-term construction-related effects include removal of riparian vegetation and IWM from the streambank that may result in the loss of overhead and instream cover. The wetland benches, planted with emergent aquatic vegetation, are expected to provide suitable spawning and rearing habitat for delta smelt at these sites, resulting in relatively rapid recovery from initial deficits in spawning and incubation and juvenile rearing habitat caused primarily by removal of existing aquatic vegetation during Project construction. Proposed planting of emergent vegetation at these sites would enhance habitat complexity by providing cover, incubation habitat, and possibly spawning habitat, especially during high winter and spring flows. The on-site mitigation Project effects at these sites would be beneficial to all delta smelt life stages.

The SAM model results indicate initial reductions in habitat values for delta smelt spawning and incubation and juvenile rearing life stages at all five sites, with rapid recovery and long-term habitat benefits in all seasons where they are present (i.e., Winter, Spring, and Fall). Model results indicate immediate gains in summer habitat for spawning and incubation and juvenile rearing at sites RM 19.4R and 43.7R. At sites RM 16.9L, 19.0R, and 22.7R, excess IWM wood credited at 40% bank line cover from nearby sites upstream of RM 30 was not credited during summer because the anchored wood would normally be above the summer water surfaces. Nevertheless, the SAM modeling indicates positive summer habitat responses for spawning, incubation, and juvenile rearing by Year 5. This is primarily the results of increased cover values provided by planted wetland benches at these sites.

Group 2: *Five sites with planted riparian benches and restricted planting plans (sites RM 33.0R, 33.3R, 44.7R, 47.9R, and 48.2R)*

3.3.3 Salmon and steelhead

Similar to the effects of construction incurred at the Group 1 sites, the implementation of the Project within the five sites of Group 2—with planted wetland and riparian benches and restricted planting plans (sites RM 33.0R, 33.3R, 44.7R, 47.9R, and 48.2R)—would result in temporary losses of aquatic and riparian vegetation and IWM along the affected shorelines.

The SAM model results indicate potential short-term habitat deficits in winter and spring, with recovery to pre-Project conditions by Year 5, and potential long-term habitat deficits in summer and fall, with recovery to pre-Project conditions of juvenile and smolt life-stages occurring at sites RM 33.0R and 33.3R by Year 25. Initial habitat losses occur for most salmonid life stages at all sites, and would contribute to longer-term summer and fall habitat deficits for adults at sites where they are seasonally present. These cover losses, however, would occur concurrently with construction of planted riparian benches at the five sites that serve to enhance habitat value to juvenile and smolt life-stages during winter and spring high flows.

Changes in bank slope and substrate size will also occur due to construction activities. All sites within this Project design group will have a long-term decrease in bank slope during winter and spring seasons resulting in positive habitat value for juvenile and smolt life-stages. These life-stages are expected to additionally benefit from the long-term decrease in substrate sizes at the five sites during winter and spring.

Anchored IWM, placed on the banks at the five Sacramento River sites would result in a net increase in IWM at winter and spring water levels. The immediate increase in winter and spring instream structure at the five sites contributes to wet season gains in habitat value for all species and life stages present. In summer and fall, however, anchored IWM would not be usable at the site because IWM would be placed above the mean summer water line and would therefore not be inundated during typical summer and fall (i.e., low) flows. This effective seasonal reduction in IWM, an important structural habitat component for salmonid juveniles and smolts, would result in long-term deficits in summer and fall habitat for juveniles and smolts at sites where increases in riparian shade are not sufficient to compensate for the loss of instream structure (i.e., sites RM 44.7R, 47.9R, and 48.2R). The loss of IWM cover during summer and fall would also result in long-term reductions in summer and fall habitat value at the site for migrating adult salmon and steelhead and for resident adult steelhead. Adult steelhead are particularly susceptible to reductions in summer and fall IWM due to the potential importance of instream cover for adults that may be resident or migrating upstream. The initial habitat deficit for juveniles and smolts modeled by the SAM at the five sites is driven by the loss of instream and overhead cover during Project construction.

The addition of anchored IWM at these sites would compensate for initial winter and spring losses of juvenile, smolt, and adult habitat modeled at many of these upstream sites, with net increases in winter and spring habitat for these life stages occurring no later than Year 5. In summer and fall, when added IWM would be above the mean water line and not available as habitat, initial juvenile and smolt habitat deficits at most sites would be gradually compensated by increasing riparian shade. SAM model results indicate a net increase in summer and fall habitat by Year 15 at site RM 33.3R and by Year 25 at site RM 33.0R.

A reduction in shade as a consequence of the temporary loss of riparian canopy cover would lessen the habitat value for adult salmonids due to reduced cover available for potential resting and holding habitat during upstream migration (Chinook salmon and steelhead) and residence (steelhead). Over time, the increasing shade value of planted riparian vegetation would result in eventual net increases in juvenile and smolt habitat in summer and fall at the five sites. However, at sites RM 44.7R, 47.9R, and 48.2R, increased riparian shade is not sufficient to compensate for summer and fall reductions in juvenile and smolt cover caused by the permanent losses of IWM and the initial and continued lack of aquatic vegetation.

In summary, summer and fall rearing habitat for salmonid juveniles and smolts would not recover to pre-Project conditions over the 50-year planning period at sites RM 44.7R, 47.9R, and 48.2R. The lasting habitat deficits modeled by the SAM are attributable to unrecovered losses of instream structure under summer and fall flow conditions at all sites, and a slight steepening of the banks at the summer and fall waterline at sites RM 44.7R and 48.2R. For adult salmon and steelhead, initial losses of summer and fall habitat for upstream migration (both species) and resident fish (steelhead) caused by reductions in available IWM would persist through Year 50 at all five sites, although small increases in summer and fall habitat occur over this time period. The observed discrepancy between adult Chinook salmon and steelhead response is driven by the greater sensitivity of steelhead to reduced instream structure and overhanging shade. It is possible, however, that recovery may occur more rapidly, since the SAM model was run for a worst-case scenario in terms of loss of existing IWM and riparian shade values due to construction impacts (Tables I-4 through I-31). The establishment and growth of riparian vegetation on the riparian benches at all five sites is expected to increase habitat values by increasing the extent of instream and overhead cover available to juvenile salmonids.

3.3.4 Delta smelt

Delta smelt may be present at any of the Project sites throughout their life cycle. The loss of overhead and instream cover may occur as a result of riparian vegetation and IWM removal from the streambank during Project construction. At the five sites, the Project design includes placement of anchored IWM above the mean summer water line, but no wetland habitat would be created. Although planted riparian vegetation would result in a long-term net increase in shade at these sites, the added IWM at these sites would not provide usable habitat during summer and no increase in summer availability of aquatic vegetation is expected to occur. Initial losses of instream and overhead cover during summer would therefore not be compensated by Project design features and summer habitat for the spawning and incubation and juvenile rearing life stages is not expected to recover to pre-Project conditions. Because none of these Project design features would fully compensate for long-term reductions in nearshore summer habitat values at these sites, the Project would adversely affect summer spawning and incubation and juvenile rearing habitat for delta smelt. In winter and spring, the seasonal inundation of anchored IWM at these Sacramento River sites is expected to provide cover and may provide necessary submerged substrates for delta smelt spawning. Winter and spring inundation of shoreline vegetation at these sites would also increase seasonal availability of complex habitat for rearing larvae and juveniles. These features would result in rapid recovery of initial habitat deficits for spawning and incubation and juvenile rearing, and net benefits for these life stages.

Although the proposed Project would result in summer losses of shade and complex shoreline habitat at nearly all sites upstream and inclusive of RM 33, the actual effect of these losses on delta smelt is unlikely to be substantial because delta smelt do not typically occur upstream of RM 20 (Moyle 2002). Even during periods of low Sacramento River outflow, when delta smelt distribution is at its farthest upstream extent, the highest delta smelt abundance consistently occurs near Decker Island (RM 8) (Bennett 2000).

The SAM model results of changes in habitat values to delta smelt affected by Project construction impacts and proposed mitigation features indicate initial reductions in habitat for spawning, incubation, and juvenile rearing life stages at sites RM 33.0R, 44.7R, 47.9R, and 48.2R, with rapid recovery and long-term habitat benefits in winter and spring by Year 5. Model results indicate immediate gains in winter and spring habitat for these life-stages at site RM 33.3R. Deficits in summer spawning, incubation, and rearing habitat would persist through the modeled 50-year period at all five sites. Long-term deficits in summer habitat for spawning, incubation, and rearing are greatest at site RM 44.7R due primarily to large losses of existing riparian shade and un-recovered losses of instream structure under summer and fall flow conditions. However, while the proposed Project would result in summer losses of shade and complex shoreline habitat at nearly all five sites in this group, the actual effect of these losses on delta smelt is unlikely to be substantial because delta smelt do not typically occur upstream of RM 20 (Moyle 2002). Even during periods of low Sacramento River outflow, when delta smelt distribution is at its farthest upstream extent, the highest delta smelt abundance consistently occurs near Decker Island (RM 8) (Bennett 2000). Although these impacts are not expected to be significant at these five sites due to the typical restricted downstream distribution of delta smelt, SAM results indicate that off-site mitigation would be required to offset potentially significant long-term impacts on spawning and incubation and juvenile rearing habitat.

Group 3*: Four sites with planted riparian benches and unrestricted planting plans (sites RM 47.0L, 62.5R, 68.9L, and 78.0L)*

3.3.5 Salmon and steelhead

Similar to the effects of construction incurred at the Groups 1 and 2 sites, the implementation of the Project within the four sites of Group 2—with planted riparian benches and unrestricted planting plans (sites RM 47.0L, 62.5R, 68.9L, and 78.0L)—would result in temporary losses of aquatic and riparian vegetation and IWM along the affected shorelines. The SAM model results indicate potential short-term habitat deficits in winter and spring, with recovery to pre-Project conditions by Year 5, and potential long-term habitat deficits in summer and fall, with recovery to pre-Project conditions of juvenile and smolt life-stages occurring at sites RM 68.9L and 78.0L by Year 50. Initial habitat losses occur for most salmonid life stages at all sites, and would contribute to longer-term summer and fall habitat deficits for adults at sites where they are seasonally present. These cover losses, however, would occur concurrently with construction of planted riparian benches at the five sites that serve to enhance habitat value to juvenile and smolt life-stages during winter and spring high flows.

Changes in bank slope and substrate size will also occur due to construction activities. All sites within this Project design group will have a long-term decrease in bank slope during winter and spring seasons resulting in positive habitat value for juvenile and smolt life-stages. These life-stages are expected to additionally benefit from the long-term decrease in substrate sizes at the five sites during winter and spring.

Anchored IWM, placed on the riparian benches at the four sites would result in a net increase in IWM at winter and spring water levels. The immediate increase in winter and spring instream structure at the four sites contributes to wet season gains in habitat value for all species and life stages present. In summer and fall, however, anchored IWM would not be usable at the site because IWM would be placed above the mean summer water line and would therefore not be inundated during typical summer and fall (i.e., low) flows. This effective seasonal reduction in IWM, an important structural habitat component for salmonid juveniles and smolts, would result in long-term deficits in summer and fall habitat for juveniles and smolts at sites where increases in riparian shade are not sufficient to compensate for the loss of instream structure at sites RM 68.9L and 78.0L. The loss of IWM cover during summer and fall would also result in long-term reductions in summer and fall habitat value at the site for migrating adult salmon and steelhead and for resident adult steelhead. Only at sites RM 68.9L and 78.0L would the eventual increase in summer and fall overhead cover be sufficient to compensate for the loss of habitat and produce habitat gains sufficient to approach or exceed pre-Project conditions for adults of both species.

In summer and fall, when IWM added would be above the mean water line and not available as habitat, initial juvenile and smolt habitat deficits at most sites would be gradually compensated by increasing riparian shade. SAM model results indicate a net increase in summer and/or fall habitat for juveniles by Year 25 at sites RM 47.0L and 68.9L and by Year 50 (in fall only) at site RM 78.0L.

A reduction in shade as a consequence of the temporary loss of riparian canopy cover would lessen the habitat value for adult salmonids due to reduced cover available for potential resting and holding habitat during upstream migration (Chinook salmon and steelhead) and residence (steelhead). Over time, the increasing shade value of planted riparian vegetation would result in eventual net increases in juvenile and smolt habitat in summer and fall at the four sites. However, at sites RM 47.0L, 68.9L and 78.0L, increased riparian shade is not sufficient to compensate for summer and fall reductions in juvenile and smolt cover caused by the permanent losses of IWM and the initial and continued lack of aquatic vegetation. Differences in life stage-specific SAM response curves for shoreline cover variables and discrepancies in initial (pre-Project) shade values between summer and fall at some sites result in modeled differences in recovery rates between juveniles and smolts and between seasons at various sites. For example, at site RM 47.0L, increasing riparian shade would relieve initial habitat deficits for juvenile spring-run Chinook salmon and create net increases in fall habitat by Year 25, but at the same site summer habitat for this species and life stage would not recover until Year 50.

In summary, summer and fall rearing habitat for salmonid juveniles and smolts would not recover to pre-Project conditions at site RM 62.5R over the 50-year period modeled by the SAM. At site RM 78.0L, losses of summer and fall habitat for Chinook salmon smolts would also fail to recover during the modeled 50-year period. The lasting habitat deficits modeled by the SAM are attributable to un-recovered losses of instream structure under summer and fall flow conditions at all sites, and a slight steepening of the banks at the summer and fall waterline at sites RM 62.5R, 68.9L, and 78.0L. At sites RM 68.9L and 78.0L, small increases in summer and fall habitat for upstream migrating adult Chinook salmon would be realized in Year 50 due to increases in overhead cover provided by maturing riparian vegetation. Fall habitat value for adult migrant and resident steelhead would return to pre-Project conditions by Year 50 at Sacramento River sites RM 68.9L and 78.0L, as would summer habitat value at site RM 68.9L. At site RM 78.0L, however, the summer habitat deficit for adult migrant and resident steelhead would persist through the modeled 50-year period. The observed discrepancy between adult Chinook salmon and steelhead response is driven by the greater sensitivity of steelhead to reduced instream structure and overhanging shade. It is possible, however, that recovery may occur more rapidly, since the SAM model was run for assuming worst-case scenario in terms of loss of existing IWM and riparian shade values due to construction impacts (Tables I-4 through I-31). The establishment and growth of riparian vegetation on the riparian benches at all sites is expected to increase habitat values by increasing the extent of instream and overhead cover available to juvenile salmonids.

3.3.6 Delta smelt

Delta smelt may be present at any of the Project sites throughout their life cycle, however delta smelt do not typically occur upstream of RM 20 (Moyle 2002). The loss of overhead and instream cover may occur as a result of riparian vegetation and IWM removal from the streambank during Project construction. At the four sites, the Project design includes placement of anchored IWM above the mean summer water line, but no wetland habitat would be created. Although planted riparian vegetation would result in a long-term net increase in shade at these sites, the added IWM at these sites would not provide usable habitat during summer and no increase in summer availability of aquatic vegetation is expected to occur. Initial losses of instream and overhead cover during summer would therefore not be compensated by Project design features and summer habitat for the spawning and incubation and juvenile rearing life stages is not expected to recover to pre-Project conditions. Because none of these Project design features would fully compensate for long-term reductions in nearshore summer habitat values at these sites, the Project would adversely affect summer spawning and incubation and juvenile rearing habitat for delta smelt. In winter and spring, the seasonal inundation of anchored IWM at these Sacramento River sites is expected to provide cover and may provide necessary submerged substrates for delta smelt spawning. Winter and spring inundation of shoreline vegetation at these sites would also increase seasonal availability of complex habitat for rearing larvae and juveniles. These features would result in rapid recovery of initial habitat deficits for spawning and incubation and juvenile rearing, and net benefits for these life stages.

The SAM model results of changes in habitat values to delta smelt affected by Project construction impacts and proposed mitigation features indicate initial reductions in habitat for spawning, incubation, and juvenile rearing life stages at sites RM 47.0L, 62.5R, and 68.9L, with rapid recovery and long-term habitat benefits in winter and spring where by Year 5. Model results indicate immediate gains in winter and spring habitat for these life-stages at site RM 78.0L. Deficits in summer spawning, incubation, and rearing habitat would persist through the modeled 50-year period at all four sites. These deficits indicate that off-site mitigation would be required to offset the potentially significant long-term impacts to habitat quality, despite that these impacts are not expected to be significant due to the typical restricted downstream distribution of delta smelt.

4 DISCUSSION

4.1 Salmon and steelhead

SAM results indicate that there are no long-term effects on winter and spring habitat upon any life stage of special-status salmon and steelhead (Tables I-60 through I-63). During winter and spring the Project is expected to provide long-term increases in habitat for Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead.

In summer and fall when river stage is lowest, mitigation features included in the Project design would not compensate for potentially significant long-term impacts on habitat at the majority of sites for upstream migrating adult salmon and steelhead and resident steelhead (Tables I-60 and I-61). Potentially significant long-term impacts on habitat for rearing juveniles and outmigrating smolts at sites RM 44.7R, 47.0L, 47.9R, 48.2R, 62.5R and 78.0L are not mitigated by Project design features. Off-site mitigation would be required to mitigate these impacts to less than significant levels. Because the species timing tables developed for the SAM (USACE 2004) indicate that juvenile rearing and smolt outmigration occur at similar times of year at other locations within the SRBPP (RM 0–194), mitigation sites may potentially be considered in other reaches of the Sacramento River. NMFS (2001) guidance on the maximum distance between impact and mitigation sites (< 50 miles) and the availability of other suitable habitat in the vicinity of these upstream Sacramento River sites would be considered in developing proposed off-site mitigation sites.

4.2 Delta smelt

Potential long-term adverse impacts on delta smelt and their critical habitat are expected to occur only under summer flow conditions at sites RM 33.0R, 33.3 R, 44.7R, 47.0L, 47.9R, 48.2R, 62.5R, 68.9L, and 78.0L (Tables I-32 through I-63). Although these impacts are not expected to be significant due to the typical restricted downstream distribution of delta smelt, SAM results indicate that off-site mitigation would be required to offset potentially significant long-term impacts on spawning and incubation and juvenile rearing habitat. Because delta smelt are restricted to waters with suitable salinity, prior USFWS (2001) recommendations indicate that potential mitigation sites should be located within the lower reaches of the SRBPP (RM 0–80). Within this reach, areas downstream of RM 20 are likely to be the most used by delta smelt (Moyle 2002).

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Appendix I

Tables

Table I-1
Summary of planned on-site mitigation features at project sites

Site	Wetland Bench	Anchored Wood	Riparian Bench	Planting Plan
RM 16.9L	Yes		Yes	Restricted
RM 19.0R	Yes		Yes	Restricted
RM 19.4R	Yes		Yes	Restricted
RM 22.7R	Yes		Yes	Restricted
RM 33.0R		Yes	Yes	Restricted
RM 33.3R		Yes	Yes	Restricted
RM 43.7R	Yes	Yes	Yes	Restricted
RM 44.7R		Yes	Yes	Restricted
RM 47.0L		Yes	Yes	Restricted
RM 47.9R		Yes	Yes	**Un-restricted**
RM 48.2R		Yes	Yes	Restricted
RM 62.5R		Yes	Yes	**Un-restricted**
RM 68.9L		Yes	Yes	**Un-restricted**
RM 78.0L		Yes	Yes	**Un-restricted**

Table I-2

Generalized planting plan used for shade modeling for 14 winter 2006 priority sites

Species	Common Name	Restricted	Unrestricted
Acer negundo	box elder		23
Alnus rhombifolia	white alder		23
Fraxinus latifolia	Oregon ash		23
Platanus racemosa	Western sycamore		23
Populus fremontii	Fremont cottonwood		115
Quercus lobata	Valley oak		46
Salix gooddingii	Goodding's willow		46
Salix laevigata	red willow	427	46
Salix lasiolepis	arroyo willow		46
Rosa californica	California wild rose		23
Salix exigua	Narrowleaf willow	860	46
	Total per ha (hex)	1,283	462

Table I-3
Modeled shade evolution for 14 winter 2006 priority sites

a) Shade estimates for restricted planting plan at:
Sacramento RMs: 16.9L, 33.0R, 33.3R, 43.7R, 44.7R, 47.9R, 48.2R
Steamboat Slough RMs: 19.0R, 19.4R, 22.7R

Year	Fall	Winter	Spring	Summer
Setback from water (ft)	5	0	0	5
Year				
0	0%	0%	0%	0%
1	0%	0%	1%	0%
5	0%	1%	11%	0%
15	61%	5%	42%	61%
25	97%	7%	62%	97%
50	99%	7%	63%	99%

b) Shade estimates for unrestricted planting plan at:
Sacramento RMs: 47.0L, 62.5R, 68.9L, 78.0L

	Fall	Winter	Spring	Summer
Setback from water (ft)	25	15	15	25
Year				
0	0%	0%	0%	0%
1	0%	0%	1%	0%
5	0%	1%	11%	0%
15	74%	5%	49%	74%
25	100%	12%	75%	100%
50	100%	25%	75%	100%

Table I-4
SAM Data Summary for Existing Conditions at Sacramento River Site RM 16.9L

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	1.9	2.9	2.6	2.1
Wetted Area (square feet)	187,489	191,499	190,749	188,837
Shoreline Length (feet)	655	588	598	672
Bank Slope (dW:dH)	6.8	4.4	4.8	6.2
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.02	1.02	1
Bank Substrate Size (D50 in inches)	20	20	20	20
Instream Structure (% shoreline)	14	14	14	14
Vegetation (% shoreline)	0	88	88	0
Shade (% shoreline)	64	16	49	65

Table I-5
SAM Data Summary of Project Conditions for Sacramento River Site RM 16.9L

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	1.9	2.9	2.6	2.1
Wetted Area (square feet)	187,489	191,499	190,749	188,837
Shoreline Length (feet)	655	588	598	672
Bank Slope (dW:dH)	10	4	4	10
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.02	1.02	1
Bank Substrate Size (D50 in inches)				
Year 0	20	8	8	8
Years 1-50	4	0.25	0.25	4
Instream Structure (% shoreline)				
Year 0	0	0	0	0
Years 1-50	0	40	40	0
Vegetation (% shoreline)				
Year 0	0	0	0	0
Year 1	50	50	50	50
Year 5	90	90	90	90
Year 15	100	100	100	100
Year 25	100	100	100	100
Year 50	100	100	100	100
Shade (% shoreline)				
Year 0	16	4	12	16
Year 1	16	4	13	16
Year 5	16	9	27	16
Year 15	77	23	68	77
Year 25	100	32	95	100
Year 50	100	32	96	100

Table I-6
SAM Data Summary for Existing Conditions at Steamboat Slough Site RM 19.0R

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	1.9	2.9	2.6	2.1
Wetted Area (square feet)	219,954	223,582	223,157	221,078
Shoreline Length (feet)	792	791	791	793
Bank Slope (dW:dH)	6.9	4.6	5.0	6.0
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.03	1.03	1
Bank Substrate Size (D50 in inches)	0.25	0.25	0.25	0.25
Instream Structure (% shoreline)	18	18	18	18
Vegetation (% shoreline)	0	86	86	0
Shade (% shoreline)	54	16	49	63

Table I-7
SAM Data Summary of Project Conditions for Steamboat Slough Site RM 19.0R

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	1.9	2.9	2.6	2.1
Wetted Area (square feet)	219,954	223,582	223,157	221,078
Shoreline Length (feet)	792	791	791	793
Bank Slope (dW:dH)	10	5	5	10
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.03	1.03	1
Bank Substrate Size (D50 in inches)				
Year 0	0.25	8	8	8
Years 1-50	4	0.25	0.25	4
Instream Structure (% shoreline)				
Year 0	0	0	0	0
Years 1-50	0	40	40	0
Vegetation (% shoreline)				
Year 0	0	0	0	0
Year 1	50	50	50	50
Year 5	90	90	90	90
Year 15	100	100	100	100
Year 25	100	100	100	100
Year 50	100	100	100	100
Shade (% shoreline)				
Year 0	14	4	12	16
Year 1	14	4	13	16
Year 5	14	9	27	16
Year 15	74	23	68	77
Year 25	100	32	95	100
Year 50	100	32	96	100

Table I-8
SAM Data Summary for Existing Conditions at Steamboat Slough Site RM 19.4R

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	1.9	2.9	2.6	2.1
Wetted Area (square feet)	91,310	92,070	91,920	91,595
Shoreline Length (feet)	359	367	357	357
Bank Slope (dW:dH)	4.0	3.2	3.3	3.6
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.02	1.02	1
Bank Substrate Size (D50 in inches)	0.25	0.25	0.25	0.25
Instream Structure (% shoreline)	4	4	4	4
Vegetation (% shoreline)	0	63	63	0
Shade (% shoreline)	86	24	73	97

Table I-9
SAM Data Summary of Project Conditions for Steamboat Slough Site RM 19.4R

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	1.9	2.9	2.6	2.1
Wetted Area (square feet)	91,310	92,070	91,920	91,595
Shoreline Length (feet)	359	367	357	357
Bank Slope (dW:dH)	10	4	4	10
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.02	1.02	1
Bank Substrate Size (D50 in inches)				
Year 0	0.25	8	8	8
Years 1-50	4	0.25	0.25	4
Instream Structure (% shoreline)				
Year 0	0	0	0	0
Years 1-50	0	40	40	0
Vegetation (% shoreline)				
Year 0	0	0	0	0
Year 1	50	50	50	50
Year 5	90	90	90	90
Year 15	100	100	100	100
Year 25	100	100	100	100
Year 50	100	100	100	100
Shade (% shoreline)				
Year 0	21	6	18	24
Year 1	21	6	19	24
Year 5	21	11	33	24
Year 15	82	25	74	85
Year 25	100	34	100	100
Year 50	100	34	100	100

Table I-10
SAM Data Summary for Existing Conditions at Steamboat Slough Site RM 22.7R

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	1.9	2.9	2.6	2.1
Wetted Area (square feet)	33,698	34,470	34,248	33,848
Shoreline Length (feet)	254	259	254	254
Bank Slope (dW:dH)	3.0	2.3	2.5	2.6
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.04	1.04	1
Bank Substrate Size (D50 in inches)	0.25	0.25	0.25	0.25
Instream Structure (% shoreline)	16	16	16	16
Vegetation (% shoreline)	0	88	88	0
Shade (% shoreline)	98	25	73	98

Table I-11

SAM Data Summary of Project Conditions for Steamboat Slough Site RM 22.7R

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	1.9	2.9	2.6	2.1
Wetted Area (square feet)	33,698	34,470	34,248	33,848
Shoreline Length (feet)	254	259	254	254
Bank Slope (dW:dH)	10	4	4	10
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.04	1.04	1
Bank Substrate Size (D50 in inches)				
Year 0	0.25	8	8	8
Years 1-50	4	0.25	0.25	4
Instream Structure (% shoreline)				
Year 0	0	0	0	0
Years 1-50	0	40	40	0
Vegetation (% shoreline)				
Year 0	0	0	0	0
Year 1	50	50	50	50
Year 5	90	90	90	90
Year 15	100	100	100	100
Year 25	100	100	100	100
Year 50	100	100	100	100
Shade (% shoreline)				
Year 0	24	6	18	24
Year 1	24	6	19	24
Year 5	24	11	33	24
Year 15	85	25	74	85
Year 25	100	34	100	100
Year 50	100	34	100	100

Table I-12

SAM Data Summary for Existing Conditions at Sacramento River Site RM 33.0R

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	2.3	3.7	3.2	2.6
Wetted Area (square feet)	105,150	106,481	106,095	105,425
Shoreline Length (feet)	389	386	389	389
Bank Slope (dW:dH)	2.8	2.6	2.7	2.8
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.03	1.04	1
Bank Substrate Size (D50 in inches)	20	20	20	20
Instream Structure (% shoreline)	8	8	8	8
Vegetation (% shoreline)	0	88	88	0
Shade (% shoreline)	34	9	26	34

Table I-13
SAM Data Summary of Project Conditions for Sacramento River Site RM 33.0R

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	2.3	3.7	3.2	2.6
Wetted Area (square feet)	105,150	106,481	106,095	105,425
Shoreline Length (feet)	389	386	389	389
Bank Slope (dW:dH)	2	10	10	2
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.03	1.04	1
Bank Substrate Size (D50 in inches)				
Year 0	20	8	8	8
Years 1-50	4	0.25	0.25	4
Instream Structure (% shoreline)				
Year 0	0	0	0	0
Years 1-50	0	40	40	0
Vegetation (% shoreline)				
Year 0	0	0	0	0
Year 1	0	50	50	0
Year 5	0	85	85	0
Year 15	0	85	85	0
Year 25	0	85	85	0
Year 50	0	85	85	0
Shade (% shoreline)				
Year 0	8	2	7	9
Year 1	8	3	8	9
Year 5	8	7	21	9
Year 15	69	21	62	69
Year 25	100	30	89	100
Year 50	100	30	91	100

Table I-14
SAM Data Summary for Existing Conditions at Sacramento River Site RM 33.3R

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	2.3	3.7	3.3	2.6
Wetted Area (square feet)	72,433	73,069	72,919	72,633
Shoreline Length (feet)	268	263	263	268
Bank Slope (dW:dH)	1.9	1.9	1.9	2.0
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.03	1.04	1
Bank Substrate Size (D50 in inches)	20	20	20	20
Instream Structure (% shoreline)	6	6	6	6
Vegetation (% shoreline)	0	88	88	0
Shade (% shoreline)	61	16	47	15

Table I-15
SAM Data Summary of Project Conditions for Sacramento River Site RM 33.3R

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	2.3	3.7	3.3	2.6
Wetted Area (square feet)	72,433	73,069	72,919	72,633
Shoreline Length (feet)	268	263	263	268
Bank Slope (dW:dH)	2	10	10	2
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.03	1.04	1
Bank Substrate Size (D50 in inches)				
Year 0	20	8	8	8
Years 1-50	4	0.25	0.25	4
Instream Structure (% shoreline)				
Year 0	0	0	0	0
Years 1-50	0	40	40	0
Vegetation (% shoreline)				
Year 0	0	0	0	0
Year 1	0	50	50	0
Year 5	0	85	85	0
Year 15	0	85	85	0
Year 25	0	85	85	0
Year 50	0	85	85	0
Shade (% shoreline)				
Year 0	15	4	12	15
Year 1	15	4	13	15
Year 5	15	9	26	15
Year 15	76	23	68	76
Year 25	100	32	95	100
Year 50	100	32	96	100

Table I-16

SAM Data Summary for Existing Conditions at Sacramento River Site RM 43.7R

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	3.6	6.0	5.1	4.1
Wetted Area (square feet)	321,970	332,516	328,884	324,320
Shoreline Length (feet)	1,221	1,202	1,207	1,201
Bank Slope (dW:dH)	2.1	2.1	2.1	2.1
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.06	1.07	1
Bank Substrate Size (D50 in inches)	0.25	0.25	0.25	0.25
Instream Structure (% shoreline)	6	6	6	6
Vegetation (% shoreline)	0	65	65	0
Shade (% shoreline)	60	20	54	65

Table I-17
SAM Data Summary of Project Conditions for Sacramento River Site RM 43.7R

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	3.6	6.0	5.1	4.1
Wetted Area (square feet)	321,970	332,516	328,884	324,320
Shoreline Length (feet)	1,221	1,202	1,207	1,201
Bank Slope (dW:dH)	10	5	5	10
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.06	1.07	1
Bank Substrate Size (D50 in inches)				
Year 0	0.25	8	8	8
Years 1-50	4	0.25	0.25	4
Instream Structure (% shoreline)				
Year 0	0	0	0	0
Years 1-50	0	40	40	0
Vegetation (% shoreline)				
Year 0	0	0	0	0
Year 1	50	50	50	50
Year 5	90	90	90	90
Year 15	100	100	100	100
Year 25	100	100	100	100
Year 50	100	100	100	100
Shade (% shoreline)				
Year 0	15	5	14	16
Year 1	15	5	15	16
Year 5	15	10	28	16
Year 15	76	24	69	77
Year 25	100	33	96	100
Year 50	100	33	98	100

Table I-18

SAM Data Summary for Existing Conditions at Sacramento River Site RM 44.7R

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	3.7	6.2	5.3	4.3
Wetted Area (square feet)	530,252	540,512	537,052	532,526
Shoreline Length (feet)	2,159	2,153	2,156	2,158
Bank Slope (dW:dH)	2.5	2.5	2.5	2.5
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.06	1.07	1
Bank Substrate Size (D50 in inches)	0.25	0.25	0.25	0.25
Instream Structure (% shoreline)	15	15	15	15
Vegetation (% shoreline)	0	80	80	0
Shade (% shoreline)	92	24	71	93

Table I-19

SAM Data Summary of Project Conditions for Sacramento River Site RM 44.7R

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	3.7	6.2	5.3	4.3
Wetted Area (square feet)	530,252	540,512	537,052	532,526
Shoreline Length (feet)	2,159	2,153	2,156	2,158
Bank Slope (dW:dH)	2	10	10	2
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.06	1.07	1
Bank Substrate Size (D50 in inches)				
Year 0	0.25	8	8	8
Years 1-50	4	0.25	0.25	4
Instream Structure (% shoreline)				
Year 0	0	0	0	0
Years 1-50	0	40	40	0
Vegetation (% shoreline)				
Year 0	0	0	0	0
Year 1	0	50	50	0
Year 5	0	85	85	0
Year 15	0	85	85	0
Year 25	0	85	85	0
Year 50	0	85	85	0
Shade (% shoreline)				
Year 0	23	6	18	23
Year 1	23	6	19	23
Year 5	23	11	32	23
Year 15	84	25	74	84
Year 25	100	34	100	100
Year 50	100	34	100	100

Table I-20
SAM Data Summary for Existing Conditions at Sacramento River Site RM 47.0L

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	4.0	6.7	5.8	4.6
Wetted Area (square feet)	312,175	339,699	330,023	318,437
Shoreline Length (feet)	1,665	1,592	1,618	1,659
Bank Slope (dW:dH)	7.8	6.3	7.2	7.5
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.10	1.14	1
Bank Substrate Size (D50 in inches)	1	1	1	1
Instream Structure (% shoreline)	6	6	6	6
Vegetation (% shoreline)	0	88	88	0
Shade (% shoreline)	11	10	18	15

Table I-21
SAM Data Summary of Project Conditions for Sacramento River Site RM 47.0L

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	4.0	6.7	5.8	4.6
Wetted Area (square feet)	312,175	339,699	330,023	318,437
Shoreline Length (feet)	1,665	1,592	1,618	1,659
Bank Slope (dW:dH)	10	4	4	10
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.10	1.14	1
Bank Substrate Size (D50 in inches)				
Year 0	1	8	8	8
Years 1-50	4	0.25	0.25	4
Instream Structure (% shoreline)				
Year 0	0	0	0	0
Years 1-50	0	40	40	0
Vegetation (% shoreline)				
Year 0	0	0	0	0
Year 1	0	50	50	0
Year 5	0	85	85	0
Year 15	0	85	85	0
Year 25	0	85	85	0
Year 50	0	85	85	0
Shade (% shoreline)				
Year 0	3	2	5	4
Year 1	3	3	6	4
Year 5	3	7	19	4
Year 15	76	24	70	77
Year 25	100	50	100	100
Year 50	100	100	100	100

Table I-22

SAM Data Summary for Existing Conditions at Sacramento River Site RM 47.9R

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	4.1	6.9	5.9	4.8
Wetted Area (square feet)	362,322	372,388	368,908	364,822
Shoreline Length (feet)	1,237	1,172	1,237	1,277
Bank Slope (dW:dH)	3.1	2.8	3.1	3.1
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.07	1.08	1
Bank Substrate Size (D50 in inches)	7	7	7	7
Instream Structure (% shoreline)	14	14	14	14
Vegetation (% shoreline)	0	79	79	0
Shade (% shoreline)	45	17	46	53

Table I-23
SAM Data Summary of Project Conditions for Sacramento River Site RM 47.9R

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	4.1	6.9	5.9	4.8
Wetted Area (square feet)	362,322	372,388	368,908	364,822
Shoreline Length (feet)	1,237	1,172	1,237	1,277
Bank Slope (dW:dH)	10	8	8	10
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.07	1.08	1
Bank Substrate Size (D50 in inches)				
Year 0	7	8	8	8
Years 1-50	4	0.25	0.25	4
Instream Structure (% shoreline)				
Year 0	0	0	0	0
Years 1-50	0	40	40	0
Vegetation (% shoreline)				
Year 0	0	0	0	0
Year 1	0	50	50	0
Year 5	0	85	85	0
Year 15	0	85	85	0
Year 25	0	85	85	0
Year 50	0	85	85	0
Shade (% shoreline)				
Year 0	11	4	12	13
Year 1	11	5	13	13
Year 5	11	9	26	13
Year 15	72	23	67	74
Year 25	100	32	94	100
Year 50	100	32	96	100

Table I-24
SAM Data Summary for Existing Conditions at Sacramento River Site RM 48.2R

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	4.2	7.0	6.0	4.8
Wetted Area (square feet)	272,953	281,403	278,119	274,453
Shoreline Length (feet)	1,132	1,137	1,127	1,152
Bank Slope (dW:dH)	2.8	2.7	2.9	2.8
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.09	1.11	1
Bank Substrate Size (D50 in inches)	0.25	0.25	0.25	0.25
Instream Structure (% shoreline)	10	10	10	10
Vegetation (% shoreline)	0	63	63	0
Shade (% shoreline)	40	17	41	45

Table I-25
SAM Data Summary of Project Conditions for Sacramento River Site RM 48.2R

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	4.2	7.0	6.0	4.8
Wetted Area (square feet)	272,953	281,403	278,119	274,453
Shoreline Length (feet)	1,132	1,137	1,127	1,152
Bank Slope (dW:dH)	2	10	10	2
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.09	1.11	1
Bank Substrate Size (D50 in inches)				
Year 0	0.25	8	8	8
Years 1-50	4	0.25	0.25	4
Instream Structure (% shoreline)				
Year 0	0	0	0	0
Years 1-50	0	40	40	0
Vegetation (% shoreline)				
Year 0	0	0	0	0
Year 1	0	50	50	0
Year 5	0	85	85	0
Year 15	0	85	85	0
Year 25	0	85	85	0
Year 50	0	85	85	0
Shade (% shoreline)				
Year 0	10	4	10	11
Year 1	10	5	11	11
Year 5	10	9	25	11
Year 15	71	23	66	72
Year 25	100	32	93	100
Year 50	100	32	94	100

Table I-26

SAM Data Summary for Existing Conditions at Sacramento River Site RM 62.5R

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	6.0	10.2	8.7	7.0
Wetted Area (square feet)	68,106	72,748	71,235	69,454
Shoreline Length (feet)	343	346	348	342
Bank Slope (dW:dH)	4.4	2.6	3.5	4.2
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.07	1.10	1
Bank Substrate Size (D50 in inches)	0.25	0.25	0.25	0.25
Instream Structure (% shoreline)	16	16	16	16
Vegetation (% shoreline)	0	63	63	0
Shade (% shoreline)	19	15	41	29

Table I-27
SAM Data Summary of Project Conditions for Sacramento River Site RM 62.5R

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	6.0	10.2	8.7	7.0
Wetted Area (square feet)	68,106	72,748	71,235	69,454
Shoreline Length (feet)	343	346	348	342
Bank Slope (dW:dH)	2	10	10	2
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.07	1.10	1
Bank Substrate Size (D50 in inches)				
Year 0	0.25	8	8	8
Years 1-50	4	0.25	0.25	4
Instream Structure (% shoreline)				
Year 0	0	0	0	0
Years 1-50	0	40	40	0
Vegetation (% shoreline)				
Year 0	0	0	0	0
Year 1	0	50	50	0
Year 5	0	85	85	0
Year 15	0	85	85	0
Year 25	0	85	85	0
Year 50	0	85	85	0
Shade (% shoreline)				
Year 0	5	4	10	7
Year 1	5	4	11	7
Year 5	5	9	25	7
Year 15	78	26	76	81
Year 25	100	52	100	100
Year 50	100	100	100	100

Table I-28
SAM Data Summary for Existing Conditions at Sacramento River Site RM 68.9L

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	6.9	11.7	9.9	8.0
Wetted Area (square feet)	193,640	208,041	202,523	196,755
Shoreline Length (feet)	1,090	1,089	1,089	1,088
Bank Slope (dW:dH)	3.4	3.5	3.6	3.6
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.13	1.16	1
Bank Substrate Size (D50 in inches)	0.25	0.25	0.25	0.25
Instream Structure (% shoreline)	6	6	6	6
Vegetation (% shoreline)	0	88	88	0
Shade (% shoreline)	0	1	0	0

Table I-29
SAM Data Summary of Project Conditions for Sacramento River Site RM 68.9L

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	6.9	11.7	9.9	8.0
Wetted Area (square feet)	193,640	208,041	202,523	196,755
Shoreline Length (feet)	1,090	1,089	1,089	1,088
Bank Slope (dW:dH)	2	10	10	2
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.13	1.16	1
Bank Substrate Size (D50 in inches)				
Year 0	0.25	8	8	8
Years 1-50	4	0.25	0.25	4
Instream Structure (% shoreline)				
Year 0	0	0	0	0
Years 1-50	0	40	40	0
Vegetation (% shoreline)				
Year 0	0	0	0	0
Year 1	0	50	50	0
Year 5	0	85	85	0
Year 15	0	85	85	0
Year 25	0	85	85	0
Year 50	0	85	85	0
Shade (% shoreline)				
Year 0	0	0	0	0
Year 1	0	1	1	0
Year 5	0	5	14	0
Year 15	74	22	65	74
Year 25	100	48	100	100
Year 50	100	100	100	100

Table I-30
SAM Data Summary for Existing Conditions at Sacramento River Site RM 78.0L

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	8.1	13.7	11.6	9.4
Wetted Area (square feet)	267,087	281,825	276,249	270,379
Shoreline Length (feet)	1,405	1,411	1,410	1,408
Bank Slope (dW:dH)	2.4	2.5	2.4	2.4
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.14	1.16	1
Bank Substrate Size (D50 in inches)	0.25	0.25	0.25	0.25
Instream Structure (% shoreline)	2	2	2	2
Vegetation (% shoreline)	0	87	87	0
Shade (% shoreline)	25	13	30	32

Table I-31
SAM Data Summary of Project Conditions for Sacramento River Site RM 78.0L

	Seasonal Values			
	Fall	Winter	Spring	Summer
Water Surface Elevation (feet)	8.1	13.7	11.6	9.4
Wetted Area (square feet)	267,087	281,825	276,249	270,379
Shoreline Length (feet)	1,405	1,411	1,410	1,408
Bank Slope (dW:dH)	2	10	10	2
Floodplain Inundation Ratio (AQ2:AQavg)	1	1.14	1.16	1
Bank Substrate Size (D50 in inches)				
Year 0	0.25	8	8	8
Years 1-50	4	0.25	0.25	4
Instream Structure (% shoreline)				
Year 0	0	0	0	0
Years 1-50	0	40	40	0
Vegetation (% shoreline)				
Year 0	0	0	0	0
Year 1	0	50	50	0
Year 5	0	85	85	0
Year 15	0	85	85	0
Year 25	0	85	85	0
Year 50	0	85	85	0
Shade (% shoreline)				
Year 0	6	3	8	8
Year 1	6	4	9	8
Year 5	6	8	22	8
Year 15	80	25	73	82
Year 25	100	51	100	100
Year 50	100	100	100	100

Table I-32
SAM results showing bank-line weighted relative response (feet) at Site RM 16.9L

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-58		-3	17		-16		0	-14		-25		-6	-14		-59		1	38	
Year 5	-58		7	70		6		16	58		0		19	67		-59		8	77	
Year 15	-51		15	88		13		27	86		11		35	94		-52		16	93	
Year 25	-45		21	96		17		35	100		17		43	102		-46		22	101	
Year 50	-39		25	103		22		42	112		22		49	107		-40		26	107	
Central Valley fall-run chinook salmon																				
Year 0	0		0	0				0	0		0			0		0			0	
Year 1	-58		-3	17				0	-14		-25			-14		-59			38	
Year 5	-58		7	70				16	58		0			67		-59			77	
Year 15	-51		15	88				27	86		11			94		-52			93	
Year 25	-45		21	96				35	100		17			102		-46			101	
Year 50	-39		25	103				42	112		22			107		-40			107	
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0	0					0	
Year 1	-58			17		-16			-14		-25		-6	-14					38	
Year 5	-58			70		6			58		0		19	67					77	
Year 15	-51			88		13			86		11		35	94					93	
Year 25	-45			96		17			100		17		43	102					101	
Year 50	-39			103		22			112		22		49	107					107	
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-58		-3	17		-16		0	-14		-25		-6	-14		-59		1		
Year 5	-58		7	70		6		16	58		0		19	67		-59		8		
Year 15	-51		15	88		13		27	86		11		35	94		-52		16		
Year 25	-45		21	96		17		35	100		17		43	102		-46		22		
Year 50	-39		25	103		22		42	112		22		49	107		-40		26		
Central Valley steelhead																				
Year 0	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
Year 1	-105		-4	-1	-105	-30		1	-21	-41	-41		-7	-28	-41	-107		3	18	-107
Year 5	-105		12	42	-105	14		26	35	8	8		28	36	8	-107		14	48	-107
Year 15	-95		24	58	-95	30		41	56	28	28		49	57	28	-98		25	62	-98
Year 25	-87		32	66	-87	37		50	66	36	36		59	64	36	-90		33	70	-90
Year 50	-81		38	73	-81	45		60	76	43	43		67	69	43	-83		40	76	-83
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-92	-92		0	0	-98	-98		0	0	-28	-28		0
Year 5	0				0	0	-2	-2		0	0	-6	-6		0	0	17	17		0
Year 15	0				0	0	14	14		0	0	10	10		0	0	24	24		0
Year 25	0				0	0	17	17		0	0	13	13		0	0	26	26		0
Year 50	0				0	0	19	19		0	0	15	15		0	0	27	27		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-33
SAM results showing bank-line weighted relative response (feet) at Site RM 19.0R

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-75		-23	-32		-28		-28	-110		-39		-49	-115		-76		-22	-26	
Year 5	-75		-16	12		1		-4	-11		-7		-14	-6		-76		-14	19	
Year 15	-66		-6	33		12		11	28		8		9	31		-68		-5	39	
Year 25	-58		1	44		17		22	47		16		20	41		-60		2	48	
Year 50	-51		7	52		23		33	63		23		29	49		-54		7	55	
Central Valley fall-run chinook salmon																				
Year 0	0		0	0				0	0		0			0		0			0	
Year 1	-75		-23	-32				-28	-110		-39			-115		-76			-26	
Year 5	-75		-16	12				-4	-11		-7			-6		-76			19	
Year 15	-66		-6	33				11	28		8			31		-68			39	
Year 25	-58		1	44				22	47		16			41		-60			48	
Year 50	-51		7	52				33	63		23			49		-54			55	
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0	0					0	
Year 1	-75			-32		-28			-110		-39		-49	-115					-26	
Year 5	-75			12		1			-11		-7		-14	-6					19	
Year 15	-66			33		12			28		8		9	31					39	
Year 25	-58			44		17			47		16		20	41					48	
Year 50	-51			52		23			63		23		29	49					55	
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-75		-23	-32		-28		-28	-110		-39		-49	-115		-76		-22		
Year 5	-75		-16	12		1		-4	-11		-7		-14	-6		-76		-14		
Year 15	-66		-6	33		12		11	28		8		9	31		-68		-5		
Year 25	-58		1	44		17		22	47		16		20	41		-60		2		
Year 50	-51		7	52		23		33	63		23		29	49		-54		7		
Central Valley steelhead																				
Year 0	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
Year 1	-141		-37	-44	-141	-54		-42	-94	-69	-69		-67	-105	-69	-141		-35	-38	-141
Year 5	-141		-24	-9	-141	5		-6	-16	-4	-4		-17	-19	-4	-141		-22	-3	-141
Year 15	-129		-10	9	-129	26		15	12	22	22		12	9	22	-130		-8	14	-130
Year 25	-118		0	20	-118	36		28	26	33	33		25	19	33	-120		1	23	-120
Year 50	-110		8	28	-110	47		42	39	42	42		36	26	42	-112		9	31	-112
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-131	-131		0	0	-135	-135		0	0	-42	-42		0
Year 5	0				0	0	-6	-6		0	0	-10	-10		0	0	12	12		0
Year 15	0				0	0	15	15		0	0	11	11		0	0	21	21		0
Year 25	0				0	0	19	19		0	0	15	15		0	0	22	22		0
Year 50	0				0	0	22	22		0	0	18	18		0	0	24	24		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-34
SAM results showing bank-line weighted relative response (feet) at Site RM 19.4R

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-19		1	17		1		-3	-20		-3		-4	-12		-19		2	19	
Year 5	-19		5	38		14		7	26		11		11	36		-19		6	40	
Year 15	-16		8	45		19		14	43		17		20	50		-16		9	47	
Year 25	-13		11	48		22		19	50		20		24	54		-13		12	50	
Year 50	-10		13	51		24		23	57		23		27	56		-11		13	52	
Central Valley fall-run chinook salmon																				
Year 0	0		0	0				0	0		0			0		0			0	
Year 1	-19		1	17				-3	-20		-3			-12		-19			19	
Year 5	-19		5	38				7	26		11			36		-19			40	
Year 15	-16		8	45				14	43		17			50		-16			47	
Year 25	-13		11	48				19	50		20			54		-13			50	
Year 50	-10		13	51				23	57		23			56		-11			52	
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0	0					0	
Year 1	-19			17		1			-20		-3		-4	-12					19	
Year 5	-19			38		14			26		11		11	36					40	
Year 15	-16			45		19			43		17		20	50					47	
Year 25	-13			48		22			50		20		24	54					50	
Year 50	-10			51		24			57		23		27	56					52	
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-19		1	17		1		-3	-20		-3		-4	-12		-19		2		
Year 5	-19		5	38		14		7	26		11		11	36		-19		6		
Year 15	-16		8	45		19		14	43		17		20	50		-16		9		
Year 25	-13		11	48		22		19	50		20		24	54		-13		12		
Year 50	-10		13	51		24		23	57		23		27	56		-11		13		
Central Valley steelhead																				
Year 0	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
Year 1	-29		0	11	-29	5		-6	-19	3	3		-7	-15	3	-28		2	14	-28
Year 5	-29		7	27	-29	33		11	17	32	32		14	22	32	-28		9	30	-28
Year 15	-25		12	33	-25	42		20	29	42	42		25	33	42	-24		13	36	-24
Year 25	-21		15	37	-21	47		25	35	47	47		30	36	47	-21		16	39	-21
Year 50	-18		18	39	-18	52		31	41	50	50		34	39	50	-18		19	41	-18
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-12	-12		0	0	-13	-13		0	0	19	19		0
Year 5	0				0	0	45	45		0	0	42	42		0	0	43	43		0
Year 15	0				0	0	54	54		0	0	51	51		0	0	47	47		0
Year 25	0				0	0	56	56		0	0	53	53		0	0	48	48		0
Year 50	0				0	0	57	57		0	0	55	55		0	0	48	48		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-35
SAM results showing bank-line weighted relative response (feet) at Site RM 22.7R

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-24		-2	4		-9		-6	-27		-12		-8	-22		-24		-1	5	
Year 5	-24		1	19		0		2	5		-2		3	12		-24		2	20	
Year 15	-21		4	24		4		7	17		2		9	22		-21		4	25	
Year 25	-19		5	25		5		10	22		4		12	24		-19		6	27	
Year 50	-18		6	27		7		13	27		6		14	26		-18		7	28	
Central Valley fall-run chinook salmon																				
Year 0	0		0					0	0		0			0		0				
Year 1	-24		-2					-6	-27		-12			-22		-24				
Year 5	-24		1					2	5		-2			12		-24				
Year 15	-21		4					7	17		2			22		-21				
Year 25	-19		5					10	22		4			24		-19				
Year 50	-18		6					13	27		6			26		-18				
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0							
Year 1	-24			4		-9			-27		-12		-8							
Year 5	-24			19		0			5		-2		3							
Year 15	-21			24		4			17		2		9							
Year 25	-19			25		5			22		4		12							
Year 50	-18			27		7			27		6		14							
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-24		-2	4		-9		-6	-27		-12		-8	-22		-24		-1		
Year 5	-24		1	19		0		2	5		-2		3	12		-24		2		
Year 15	-21		4	24		4		7	17		2		9	22		-21		4		
Year 25	-19		5	25		5		10	22		4		12	24		-19		6		
Year 50	-18		6	27		7		13	27		6		14	26		-18		7		
Central Valley steelhead																				
Year 0	0		0		0	0		0	0	0	0		0	0	0	0		0		0
Year 1	-42		-4		-42	-17		-10	-24	-19	-19		-12	-22	-19	-42		-3		-42
Year 5	-42		1		-42	2		2	1	1	1		4	5	1	-42		2		-42
Year 15	-39		4		-39	9		9	10	9	9		11	13	9	-39		5		-39
Year 25	-37		6		-37	12		13	14	12	12		15	15	12	-37		8		-37
Year 50	-35		8		-35	15		17	18	14	14		17	17	14	-35		9		-35
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-29	-29		0	0	-30	-30		0	0	-1	-1		0
Year 5	0				0	0	11	11		0	0	10	10		0	0	16	16		0
Year 15	0				0	0	18	18		0	0	16	16		0	0	19	19		0
Year 25	0				0	0	19	19		0	0	17	17		0	0	20	20		0
Year 50	0				0	0	20	20		0	0	18	18		0	0	20	20		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-36
SAM results showing bank-line weighted relative response (feet) at Site RM 33.0R

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-23		-4	-15		-1		10	25		-5		8	19		-23		-3	-5	
Year 5	-23		-3	-7		14		22	74		11		26	75		-23		-3	-5	
Year 15	-18		-1	-2		19		30	94		19		40	98		-18		-1	-1	
Year 25	-14		0	2		22		36	104		23		47	104		-14		0	3	
Year 50	-10		1	5		25		42	113		27		53	110		-10		1	5	
Central Valley fall-run chinook salmon																				
Year 0	0		0					0	0		0			0		0				
Year 1	-23		-4					10	25		-5			19		-23				
Year 5	-23		-3					22	74		11			75		-23				
Year 15	-18		-1					30	94		19			98		-18				
Year 25	-14		0					36	104		23			104		-14				
Year 50	-10		1					42	113		27			110		-10				
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0							
Year 1	-23			-15		-1			25		-5		8							
Year 5	-23			-7		14			74		11		26							
Year 15	-18			-2		19			94		19		40							
Year 25	-14			2		22			104		23		47							
Year 50	-10			5		25			113		27		53							
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-23		-4	-15		-1		10	25		-5		8	19		-23		-3		
Year 5	-23		-3	-7		14		22	74		11		26	75		-23		-3		
Year 15	-18		-1	-2		19		30	94		19		40	98		-18		-1		
Year 25	-14		0	2		22		36	104		23		47	104		-14		0		
Year 50	-10		1	5		25		42	113		27		53	110		-10		1		
Central Valley steelhead																				
Year 0	0		0		0	0		0	0	0	0		0	0	0	0		0		0
Year 1	-42		-7		-42	2		15	19	-5	-5		13	13	-5	-42		-4		-42
Year 5	-42		-5		-42	31		34	58	27	27		38	56	27	-42		-4		-42
Year 15	-35		-1		-35	41		45	73	41	41		55	74	41	-35		-1		-35
Year 25	-29		1		-29	46		52	80	48	48		64	80	48	-29		1		-29
Year 50	-24		3		-24	52		60	88	53	53		71	85	53	-24		3		-24
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-11	-11		0	0	-12	-12		0	0	-39	-39		0
Year 5	0				0	0	52	52		0	0	51	51		0	0	-39	-39		0
Year 15	0				0	0	63	63		0	0	62	62		0	0	-39	-39		0
Year 25	0				0	0	65	65		0	0	64	64		0	0	-39	-39		0
Year 50	0				0	0	67	67		0	0	66	66		0	0	-39	-39		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-38
SAM results showing bank-line weighted relative response (feet) at Site RM 43.7R

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-73		-4	37		-3		-12	-74		-17		-23	-63		-72		-4	39	
Year 5	-73		8	106		42		26	77		32		33	105		-72		9	108	
Year 15	-59		23	137		57		50	137		54		68	159		-59		23	137	
Year 25	-47		33	152		66		66	163		65		84	174		-48		33	151	
Year 50	-37		41	163		74		84	188		76		98	185		-38		41	161	
Central Valley fall-run chinook salmon																				
Year 0	0		0					0	0		0			0		0				
Year 1	-73		-4					-12	-74		-17			-63		-72				
Year 5	-73		8					26	77		32			105		-72				
Year 15	-59		23					50	137		54			159		-59				
Year 25	-47		33					66	163		65			174		-48				
Year 50	-37		41					84	188		76			185		-38				
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0							
Year 1	-73			37		-3			-74		-17		-23							
Year 5	-73			106		42			77		32		33							
Year 15	-59			137		57			137		54		68							
Year 25	-47			152		66			163		65		84							
Year 50	-37			163		74			188		76		98							
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-73		-4	37		-3		-12	-74		-17		-23	-63		-72		-4		
Year 5	-73		8	106		42		26	77		32		33	105		-72		9		
Year 15	-59		23	137		57		50	137		54		68	159		-59		23		
Year 25	-47		33	152		66		66	163		65		84	174		-48		33		
Year 50	-37		41	163		74		84	188		76		98	185		-38		41		
Central Valley steelhead																				
Year 0	0		0		0	0		0	0	0	0		0	0	0	0		0		0
Year 1	-119		-9		-119	6		-22	-68	-9	-9		-36	-69	-9	-117		-8		-117
Year 5	-119		11		-119	96		36	51	90	90		41	61	90	-117		12		-117
Year 15	-101		32		-101	127		67	94	128	128		85	104	128	-100		32		-100
Year 25	-86		47		-86	143		88	114	145	145		105	117	145	-86		46		-86
Year 50	-74		58		-74	158		109	133	159	159		121	128	159	-74		57		-74
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-66	-66		0	0	-67	-67		0	0	42	42		0
Year 5	0				0	0	125	125		0	0	126	126		0	0	123	123		0
Year 15	0				0	0	157	157		0	0	158	158		0	0	136	136		0
Year 25	0				0	0	164	164		0	0	164	164		0	0	139	139		0
Year 50	0				0	0	168	168		0	0	169	169		0	0	141	141		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-37
SAM results showing bank-line weighted relative response (feet) at Site RM 33.3R

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-16		-2	-4		0		7	19		-4		8	22		-16		-1	3	
Year 5	-16		-1	2		9		16	53		7		21	59		-16		-1	3	
Year 15	-14		0	5		13		22	67		12		29	72		-14		0	5	
Year 25	-11		1	6		15		26	73		14		33	76		-11		1	7	
Year 50	-9		1	8		16		30	78		17		37	78		-9		1	8	
Central Valley fall-run chinook salmon																				
Year 0	0		0					0	0		0			0		0				
Year 1	-16		-2					7	19		-4			22		-16				
Year 5	-16		-1					16	53		7			59		-16				
Year 15	-14		0					22	67		12			72		-14				
Year 25	-11		1					26	73		14			76		-11				
Year 50	-9		1					30	78		17			78		-9				
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0							
Year 1	-16			-4		0			19		-4		8							
Year 5	-16			2		9			53		7		21							
Year 15	-14			5		13			67		12		29							
Year 25	-11			6		15			73		14		33							
Year 50	-9			8		16			78		17		37							
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-16		-2	-4		0		7	19		-4		8	22		-16		-1		
Year 5	-16		-1	2		9		16	53		7		21	59		-16		-1		
Year 15	-14		0	5		13		22	67		12		29	72		-14		0		
Year 25	-11		1	6		15		26	73		14		33	76		-11		1		
Year 50	-9		1	8		16		30	78		17		37	78		-9		1		
Central Valley steelhead																				
Year 0	0		0		0	0		0	0	0	0		0	0	0	0		0		0
Year 1	-27		-3		-27	1		11	15	-3	-3		12	15	-3	-27		-1		-27
Year 5	-27		-1		-27	21		24	42	19	19		29	44	19	-27		-1		-27
Year 15	-23		1		-23	28		32	52	27	27		40	54	27	-23		1		-23
Year 25	-20		2		-20	31		37	57	31	31		45	58	31	-20		2		-20
Year 50	-17		3		-17	35		42	61	34	34		49	60	34	-17		3		-17
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	3	3		0	0	3	3		0	0	-19	-19		0
Year 5	0				0	0	46	46		0	0	46	46		0	0	-19	-19		0
Year 15	0				0	0	53	53		0	0	53	53		0	0	-19	-19		0
Year 25	0				0	0	54	54		0	0	54	54		0	0	-19	-19		0
Year 50	0				0	0	56	56		0	0	55	55		0	0	-19	-19		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-39
SAM results showing bank-line weighted relative response (feet) at Site RM 44.7R

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-199		-64	-187		-75		-35	-181		-101		-44	-133		-199		-64	-187	
Year 5	-199		-64	-187		5		41	101		-15		70	175		-199		-64	-186	
Year 15	-179		-59	-179		32		88	207		23		131	263		-179		-59	-178	
Year 25	-162		-55	-172		47		119	254		41		159	286		-162		-54	-171	
Year 50	-148		-51	-167		62		152	295		58		181	303		-148		-51	-167	
Central Valley fall-run chinook salmon																				
Year 0	0		0					0	0		0			0		0				
Year 1	-199		-64					-35	-181		-101			-133		-199				
Year 5	-199		-64					41	101		-15			175		-199				
Year 15	-179		-59					88	207		23			263		-179				
Year 25	-162		-55					119	254		41			286		-162				
Year 50	-148		-51					152	295		58			303		-148				
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0							
Year 1	-199			-187		-75			-181		-101		-44							
Year 5	-199			-187		5			101		-15		70							
Year 15	-179			-179		32			207		23		131							
Year 25	-162			-172		47			254		41		159							
Year 50	-148			-167		62			295		58		181							
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-199		-64	-187		-75		-35	-181		-101		-44	-133		-199		-64		
Year 5	-199		-64	-187		5		41	101		-15		70	175		-199		-64		
Year 15	-179		-59	-179		32		88	207		23		131	263		-179		-59		
Year 25	-162		-55	-172		47		119	254		41		159	286		-162		-54		
Year 50	-148		-51	-167		62		152	295		58		181	303		-148		-51		
Central Valley steelhead																				
Year 0	0		0		0	0		0	0	0	0		0	0	0	0		0		0
Year 1	-350		-110		-350	-139		-58	-151	-159	-159		-70	-129	-159	-350		-110		-350
Year 5	-350		-110		-350	23		54	69	16	16		82	108	16	-350		-110		-350
Year 15	-326		-100		-326	77		114	145	78	78		157	178	78	-326		-100		-326
Year 25	-305		-92		-305	105		152	182	105	105		189	199	105	-305		-92		-305
Year 50	-289		-86		-289	132		192	216	127	127		216	215	127	-289		-86		-289
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-181	-181		0	0	-181	-181		0	0	-291	-291		0
Year 5	0				0	0	173	173		0	0	173	173		0	0	-291	-291		0
Year 15	0				0	0	232	232		0	0	233	233		0	0	-291	-291		0
Year 25	0				0	0	244	244		0	0	244	244		0	0	-291	-291		0
Year 50	0				0	0	253	253		0	0	253	253		0	0	-291	-291		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-40
SAM results showing bank-line weighted relative response (feet) at Site RM 47.0L

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-68		-19	-88		5		-21	-127		-3		-38	-160		-73		-23	-97	
Year 5	-68		-19	-88		64		23	66		64		25	63		-73		-23	-96	
Year 15	-43		-7	-57		87		57	150		99		81	157		-48		-11	-67	
Year 25	-20		4	-32		103		86	193		118		110	187		-26		-1	-44	
Year 50	-2		11	-14		127		125	234		135		133	210		-9		7	-26	
Central Valley fall-run chinook salmon																				
Year 0	0		0					0	0		0			0		0				
Year 1	-68		-19					-21	-127		-3			-160		-73				
Year 5	-68		-19					23	66		64			63		-73				
Year 15	-43		-7					57	150		99			157		-48				
Year 25	-20		4					86	193		118			187		-26				
Year 50	-2		11					125	234		135			210		-9				
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0							
Year 1	-68			-88		5			-127		-3		-38							
Year 5	-68			-88		64			66		64		25							
Year 15	-43			-57		87			150		99		81							
Year 25	-20			-32		103			193		118		110							
Year 50	-2			-14		127			234		135		133							
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-68		-19	-88		5		-21	-127		-3		-38	-160		-73		-23		
Year 5	-68		-19	-88		64		23	66		64		25	63		-73		-23		
Year 15	-43		-7	-57		87		57	150		99		81	157		-48		-11		
Year 25	-20		4	-32		103		86	193		118		110	187		-26		-1		
Year 50	-2		11	-14		127		125	234		135		133	210		-9		7		
Central Valley steelhead																				
Year 0	0		0		0	0		0	0	0	0		0	0	0	0		0		0
Year 1	-125		-35		-125	22		-36	-115	8	8		-59	-145	8	-134		-41		-134
Year 5	-125		-35		-125	142		34	38	143	143		34	31	143	-134		-41		-134
Year 15	-87		-13		-87	187		79	100	207	207		105	105	207	-96		-20		-96
Year 25	-55		5		-55	216		115	135	236	236		141	132	236	-66		-2		-66
Year 50	-30		18		-30	254		164	171	260	260		170	153	260	-41		11		-41
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-161	-161		0	0	-174	-174		0	0	-127	-127		0
Year 5	0				0	0	87	87		0	0	80	80		0	0	-127	-127		0
Year 15	0				0	0	129	129		0	0	123	123		0	0	-127	-127		0
Year 25	0				0	0	137	137		0	0	131	131		0	0	-127	-127		0
Year 50	0				0	0	143	143		0	0	137	137		0	0	-127	-127		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-41
SAM results showing bank-line weighted relative response (feet) at Site RM 47.9R

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-102		-28	-81		-31		-14	-93		-48		-34	-103		-108		-30	-80	
Year 5	-102		-28	-81		13		26	58		2		26	74		-108		-29	-79	
Year 15	-88		-21	-68		28		51	118		26		67	134		-93		-22	-67	
Year 25	-74		-15	-57		36		69	145		38		86	151		-81		-17	-58	
Year 50	-63		-10	-49		44		87	170		49		102	164		-69		-12	-51	
Central Valley fall-run chinook salmon																				
Year 0	0		0					0	0		0			0		0				
Year 1	-102		-28					-14	-93		-48			-103		-108				
Year 5	-102		-28					26	58		2			74		-108				
Year 15	-88		-21					51	118		26			134		-93				
Year 25	-74		-15					69	145		38			151		-81				
Year 50	-63		-10					87	170		49			164		-69				
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0							
Year 1	-102			-81		-31			-93		-48		-34							
Year 5	-102			-81		13			58		2		26							
Year 15	-88			-68		28			118		26		67							
Year 25	-74			-57		36			145		38		86							
Year 50	-63			-49		44			170		49		102							
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-102		-28	-81		-31		-14	-93		-48		-34	-103		-108		-30		
Year 5	-102		-28	-81		13		26	58		2		26	74		-108		-29		
Year 15	-88		-21	-68		28		51	118		26		67	134		-93		-22		
Year 25	-74		-15	-57		36		69	145		38		86	151		-81		-17		
Year 50	-63		-10	-49		44		87	170		49		102	164		-69		-12		
Central Valley steelhead																				
Year 0	0		0		0	0		0	0	0	0		0	0	0	0		0		0
Year 1	-190		-47		-190	-56		-25	-77	-79	-79		-52	-96	-79	-198		-50		-198
Year 5	-190		-47		-190	32		34	41	23	23		31	41	23	-198		-50		-198
Year 15	-170		-35		-170	62		67	84	63	63		81	88	63	-178		-38		-178
Year 25	-152		-25		-152	78		88	105	81	81		104	104	81	-161		-28		-161
Year 50	-137		-17		-137	94		111	125	97	97		123	116	97	-147		-21		-147
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-105	-105		0	0	-119	-119		0	0	-113	-113		0
Year 5	0				0	0	87	87		0	0	84	84		0	0	-113	-113		0
Year 15	0				0	0	119	119		0	0	117	117		0	0	-113	-113		0
Year 25	0				0	0	125	125		0	0	124	124		0	0	-113	-113		0
Year 50	0				0	0	130	130		0	0	129	129		0	0	-113	-113		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-42
SAM results showing bank-line weighted relative response (feet) at Site RM 48.2R

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-81		-28	-99		-19		-5	-60		-31		-18	-64		-84		-30	-100	
Year 5	-81		-28	-99		23		34	87		15		37	100		-84		-29	-100	
Year 15	-67		-24	-88		38		59	146		37		76	157		-70		-25	-89	
Year 25	-55		-20	-79		46		76	173		48		95	174		-58		-21	-81	
Year 50	-44		-17	-72		54		95	197		58		111	186		-47		-19	-74	
Central Valley fall-run chinook salmon																				
Year 0	0		0					0	0		0			0		0				
Year 1	-81		-28					-5	-60		-31			-64		-84				
Year 5	-81		-28					34	87		15			100		-84				
Year 15	-67		-24					59	146		37			157		-70				
Year 25	-55		-20					76	173		48			174		-58				
Year 50	-44		-17					95	197		58			186		-47				
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0							
Year 1	-81			-99		-19			-60		-31		-18							
Year 5	-81			-99		23			87		15		37							
Year 15	-67			-88		38			146		37		76							
Year 25	-55			-79		46			173		48		95							
Year 50	-44			-72		54			197		58		111							
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-81		-28	-99		-19		-5	-60		-31		-18	-64		-84		-30		
Year 5	-81		-28	-99		23		34	87		15		37	100		-84		-29		
Year 15	-67		-24	-88		38		59	146		37		76	157		-70		-25		
Year 25	-55		-20	-79		46		76	173		48		95	174		-58		-21		
Year 50	-44		-17	-72		54		95	197		58		111	186		-47		-19		
Central Valley steelhead																				
Year 0	0		0		0	0		0	0	0	0		0	0	0	0		0		0
Year 1	-148		-50		-148	-30		-12	-52	-46	-46		-30	-63	-46	-152		-52		-152
Year 5	-148		-50		-148	56		46	64	47	47		47	64	47	-152		-52		-152
Year 15	-128		-41		-128	85		79	106	85	85		94	109	85	-133		-44		-133
Year 25	-112		-35		-112	100		100	126	102	102		117	124	102	-116		-37		-116
Year 50	-98		-29		-98	116		122	146	116	116		136	136	116	-103		-32		-103
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-67	-67		0	0	-70	-70		0	0	-136	-136		0
Year 5	0				0	0	120	120		0	0	116	116		0	0	-136	-136		0
Year 15	0				0	0	151	151		0	0	147	147		0	0	-136	-136		0
Year 25	0				0	0	158	158		0	0	153	153		0	0	-136	-136		0
Year 50	0				0	0	162	162		0	0	158	158		0	0	-136	-136		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-43
SAM results showing bank-line weighted relative response (feet) at Site RM 62.5R

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-26		-10	-42		-10		-4	-26		-15		-13	-35		-28		-12	-44	
Year 5	-26		-10	-42		2		8	19		-1		4	15		-28		-12	-43	
Year 15	-21		-8	-37		7		16	37		6		16	33		-23		-10	-39	
Year 25	-17		-7	-33		11		23	47		10		22	38		-19		-9	-36	
Year 50	-13		-6	-30		16		33	55		13		27	42		-16		-8	-33	
Central Valley fall-run chinook salmon																				
Year 0	0		0					0	0		0			0		0				
Year 1	-26		-10					-4	-26		-15			-35		-28				
Year 5	-26		-10					8	19		-1			15		-28				
Year 15	-21		-8					16	37		6			33		-23				
Year 25	-17		-7					23	47		10			38		-19				
Year 50	-13		-6					33	55		13			42		-16				
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0							
Year 1	-26			-42		-10			-26		-15		-13							
Year 5	-26			-42		2			19		-1		4							
Year 15	-21			-37		7			37		6		16							
Year 25	-17			-33		11			47		10		22							
Year 50	-13			-30		16			55		13		27							
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-26		-10	-42		-10		-4	-26		-15		-13	-35		-28		-12		
Year 5	-26		-10	-42		2		8	19		-1		4	15		-28		-12		
Year 15	-21		-8	-37		7		16	37		6		16	33		-23		-10		
Year 25	-17		-7	-33		11		23	47		10		22	38		-19		-9		
Year 50	-13		-6	-30		16		33	55		13		27	42		-16		-8		
Central Valley steelhead																				
Year 0	0		0		0	0		0	0	0	0		0	0	0	0		0		0
Year 1	-51		-18		-51	-20		-7	-22	-26	-26		-19	-32	-26	-54		-20		-54
Year 5	-51		-18		-51	6		11	13	3	3		5	7	3	-54		-20		-54
Year 15	-44		-15		-44	16		21	27	15	15		20	21	15	-47		-17		-47
Year 25	-38		-12		-38	22		30	34	20	20		27	26	20	-42		-15		-42
Year 50	-33		-10		-33	30		41	42	24	24		33	29	24	-37		-13		-37
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-31	-31		0	0	-40	-40		0	0	-57	-57		0
Year 5	0				0	0	26	26		0	0	17	17		0	0	-57	-57		0
Year 15	0				0	0	35	35		0	0	27	27		0	0	-57	-57		0
Year 25	0				0	0	37	37		0	0	28	28		0	0	-57	-57		0
Year 50	0				0	0	39	39		0	0	30	30		0	0	-57	-57		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-44
SAM results showing bank-line weighted relative response (feet) at Site RM 68.9L

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-34		-7	-46		12		12	-6		14		14	-1		-34		-8	-47	
Year 5	-34		-7	-46		52		46	131		59		60	159		-34		-7	-47	
Year 15	-16		-1	-25		68		73	196		85		108	237		-16		-2	-26	
Year 25	-1		3	-9		79		98	230		99		135	264		-1		3	-10	
Year 50	12		7	4		97		132	264		112		157	284		12		6	2	
Central Valley fall-run chinook salmon																				
Year 0	0		0					0	0		0			0		0				
Year 1	-34		-7					12	-6		14			-1		-34				
Year 5	-34		-7					46	131		59			159		-34				
Year 15	-16		-1					73	196		85			237		-16				
Year 25	-1		3					98	230		99			264		-1				
Year 50	12		7					132	264		112			284		12				
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0							
Year 1	-34			-46		12			-6		14		14							
Year 5	-34			-46		52			131		59		60							
Year 15	-16			-25		68			196		85		108							
Year 25	-1			-9		79			230		99		135							
Year 50	12			4		97			264		112		157							
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-34		-7	-46		12		12	-6		14		14	-1		-34		-8		
Year 5	-34		-7	-46		52		46	131		59		60	159		-34		-7		
Year 15	-16		-1	-25		68		73	196		85		108	237		-16		-2		
Year 25	-1		3	-9		79		98	230		99		135	264		-1		3		
Year 50	12		7	4		97		132	264		112		157	284		12		6		
Central Valley steelhead																				
Year 0	0		0		0	0		0	0	0	0		0	0	0	0		0		0
Year 1	-61		-15		-61	31		15	-4	35	35		18	1	35	-61		-15		-61
Year 5	-61		-15		-61	112		67	105	126	126		86	126	126	-61		-15		-61
Year 15	-33		-3		-33	144		103	152	174	174		145	186	174	-33		-4		-33
Year 25	-10		6		-10	165		133	179	196	196		177	209	196	-10		5		-10
Year 50	8		13		8	194		173	209	215	215		203	227	215	8		12		8
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-40	-40		0	0	-42	-42		0	0	-111	-111		0
Year 5	0				0	0	141	141		0	0	139	139		0	0	-111	-111		0
Year 15	0				0	0	171	171		0	0	169	169		0	0	-111	-111		0
Year 25	0				0	0	177	177		0	0	175	175		0	0	-111	-111		0
Year 50	0				0	0	182	182		0	0	180	180		0	0	-111	-111		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-45
SAM results showing bank-line weighted relative response (feet) at Site RM 78.0L

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-41		-14	-65		30		21	10		18		15	2		-45		-17	-65	
Year 5	-41		-14	-65		83		69	193		67		62	177		-45		-16	-64	
Year 15	-20		-8	-46		102		105	271		95		112	250		-26		-10	-48	
Year 25	-3		-3	-32		116		135	310		115		150	289		-9		-6	-35	
Year 50	11		1	-20		138		175	347		131		179	318		4		-2	-25	
Central Valley fall-run chinook salmon																				
Year 0	0		0					0	0		0			0		0				
Year 1	-41		-14					21	10		18			2		-45				
Year 5	-41		-14					69	193		67			177		-45				
Year 15	-20		-8					105	271		95			250		-26				
Year 25	-3		-3					135	310		115			289		-9				
Year 50	11		1					175	347		131			318		4				
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0							
Year 1	-41			-65		30			10		18		15							
Year 5	-41			-65		83			193		67		62							
Year 15	-20			-46		102			271		95		112							
Year 25	-3			-32		116			310		115		150							
Year 50	11			-20		138			347		131		179							
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-41		-14	-65		30		21	10		18		15	2		-45		-17		
Year 5	-41		-14	-65		83		69	193		67		62	177		-45		-16		
Year 15	-20		-8	-46		102		105	271		95		112	250		-26		-10		
Year 25	-3		-3	-32		116		135	310		115		150	289		-9		-6		
Year 50	11		1	-20		138		175	347		131		179	318		4		-2		
Central Valley steelhead																				
Year 0	0		0		0	0		0	0	0	0		0	0	0	0		0		0
Year 1	-70		-28		-70	68		28	18	51	51		17	4	51	-76		-31		-76
Year 5	-70		-28		-70	174		99	161	151	151		85	140	151	-76		-31		-76
Year 15	-41		-16		-41	214		145	218	200	200		147	198	200	-49		-20		-49
Year 25	-17		-6		-17	239		181	249	231	231		191	231	231	-26		-10		-26
Year 50	2		2		2	272		229	282	256	256		226	256	256	-8		-3		-8
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	88	88		0	0	90	90		0	0	-46	-46		0
Year 5	0				0	0	322	322		0	0	325	325		0	0	-46	-46		0
Year 15	0				0	0	361	361		0	0	364	364		0	0	-46	-46		0
Year 25	0				0	0	369	369		0	0	372	372		0	0	-46	-46		0
Year 50	0				0	0	375	375		0	0	378	378		0	0	-46	-46		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-46
SAM results showing wetted-area weighted relative response (square feet) at Site RM 16.9L

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-16,541		-745	4,790		-5,274		-75	-4,548		-7,877		-1,935	-4,577		-16,675		269	10,790	
Year 5	-16,541		2,011	19,982		1,824		5,305	18,743		-125		5,980	21,319		-16,675		2,327	21,624	
Year 15	-14,520		4,289	25,272		4,304		8,823	28,170		3,443		11,183	29,967		-14,647		4,491	26,182	
Year 25	-12,756		5,875	27,596		5,647		11,258	32,471		5,286		13,657	32,425		-12,878		6,055	28,352	
Year 50	-11,251		7,114	29,345		7,027		13,832	36,375		6,997		15,687	34,288		-11,369		7,278	29,986	
Central Valley fall-run chinook salmon																				
Year 0	0		0	0				0	0		0			0		0			0	
Year 1	-16,541		-745	4,790				-75	-4,548		-7,877			-4,577		-16,675			10,790	
Year 5	-16,541		2,011	19,982				5,305	18,743		-125			21,319		-16,675			21,624	
Year 15	-14,520		4,289	25,272				8,823	28,170		3,443			29,967		-14,647			26,182	
Year 25	-12,756		5,875	27,596				11,258	32,471		5,286			32,425		-12,878			28,352	
Year 50	-11,251		7,114	29,345				13,832	36,375		6,997			34,288		-11,369			29,986	
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0	0					0	
Year 1	-16,541			4,790		-5,274			-4,548		-7,877		-1,935	-4,577					10,790	
Year 5	-16,541			19,982		1,824			18,743		-125		5,980	21,319					21,624	
Year 15	-14,520			25,272		4,304			28,170		3,443		11,183	29,967					26,182	
Year 25	-12,756			27,596		5,647			32,471		5,286		13,657	32,425					28,352	
Year 50	-11,251			29,345		7,027			36,375		6,997		15,687	34,288					29,986	
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-16,541		-745	4,790		-5,274		-75	-4,548		-7,877		-1,935	-4,577		-16,675		269		
Year 5	-16,541		2,011	19,982		1,824		5,305	18,743		-125		5,980	21,319		-16,675		2,327		
Year 15	-14,520		4,289	25,272		4,304		8,823	28,170		3,443		11,183	29,967		-14,647		4,491		
Year 25	-12,756		5,875	27,596		5,647		11,258	32,471		5,286		13,657	32,425		-12,878		6,055		
Year 50	-11,251		7,114	29,345		7,027		13,832	36,375		6,997		15,687	34,288		-11,369		7,278		
Central Valley steelhead																				
Year 0	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
Year 1	-29,965		-1,280	-370	-29,965	-9,711		184	-6,979	-13,056	-13,056		-2,278	-8,903	-13,056	-30,177		873	5,087	-30,177
Year 5	-29,965		3,446	12,072	-29,965	4,660		8,554	11,450	2,592	2,592		9,019	11,335	2,592	-30,177		4,058	13,613	-30,177
Year 15	-27,278		6,800	16,632	-27,278	9,639		13,305	18,227	8,776	8,776		15,620	18,146	8,776	-27,485		7,159	17,514	-27,485
Year 25	-25,006		9,079	18,981	-25,006	12,213		16,400	21,541	11,470	11,470		18,683	20,396	11,470	-25,210		9,388	19,728	-25,210
Year 50	-23,150		10,875	20,768	-23,150	14,779		19,617	24,681	13,790	13,790		21,216	22,143	13,790	-23,352		11,146	21,414	-23,352
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-30,084	-30,084		0	0	-31,322	-31,322		0	0	-8,001	-8,001		0
Year 5	0				0	0	-526	-526		0	0	-1,864	-1,864		0	0	4,705	4,705		0
Year 15	0				0	0	4,409	4,409		0	0	3,055	3,055		0	0	6,828	6,828		0
Year 25	0				0	0	5,396	5,396		0	0	4,038	4,038		0	0	7,253	7,253		0
Year 50	0				0	0	6,136	6,136		0	0	4,776	4,776		0	0	7,572	7,572		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-47
SAM results showing wetted-area weighted relative response (square feet) at Site RM 19.0R

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-20,819		-6,526	-8,832		-7,911		-8,012	-31,025		-10,998		-13,865	-32,532		-21,240		-6,266	-7,256	
Year 5	-20,819		-4,342	3,470		375		-1,258	-3,204		-1,931		-3,923	-1,557		-21,240		-3,878	5,396	
Year 15	-18,316		-1,653	9,244		3,271		3,151	8,042		2,240		2,597	8,768		-18,843		-1,316	10,805	
Year 25	-16,115		337	12,185		4,837		6,203	13,169		4,393		5,695	11,700		-16,749		543	13,410	
Year 50	-14,214		1,899	14,400		6,447		9,427	17,821		6,392		8,238	13,923		-14,960		1,998	15,370	
Central Valley fall-run chinook salmon																				
Year 0	0		0	0				0	0		0			0		0			0	
Year 1	-20,819		-6,526	-8,832				-8,012	-31,025		-10,998			-32,532		-21,240			-7,256	
Year 5	-20,819		-4,342	3,470				-1,258	-3,204		-1,931			-1,557		-21,240			5,396	
Year 15	-18,316		-1,653	9,244				3,151	8,042		2,240			8,768		-18,843			10,805	
Year 25	-16,115		337	12,185				6,203	13,169		4,393			11,700		-16,749			13,410	
Year 50	-14,214		1,899	14,400				9,427	17,821		6,392			13,923		-14,960			15,370	
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0	0					0	
Year 1	-20,819			-8,832		-7,911			-31,025		-10,998		-13,865	-32,532					-7,256	
Year 5	-20,819			3,470		375			-3,204		-1,931		-3,923	-1,557					5,396	
Year 15	-18,316			9,244		3,271			8,042		2,240		2,597	8,768					10,805	
Year 25	-16,115			12,185		4,837			13,169		4,393		5,695	11,700					13,410	
Year 50	-14,214			14,400		6,447			17,821		6,392		8,238	13,923					15,370	
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-20,819		-6,526	-8,832		-7,911		-8,012	-31,025		-10,998		-13,865	-32,532		-21,240		-6,266		
Year 5	-20,819		-4,342	3,470		375		-1,258	-3,204		-1,931		-3,923	-1,557		-21,240		-3,878		
Year 15	-18,316		-1,653	9,244		3,271		3,151	8,042		2,240		2,597	8,768		-18,843		-1,316		
Year 25	-16,115		337	12,185		4,837		6,203	13,169		4,393		5,695	11,700		-16,749		543		
Year 50	-14,214		1,899	14,400		6,447		9,427	17,821		6,392		8,238	13,923		-14,960		1,998		
Central Valley steelhead																				
Year 0	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
Year 1	-39,174		-10,214	-12,196	-39,174	-15,335		-11,929	-26,434	-19,398	-19,398		-18,767	-29,496	-19,398	-39,448		-9,744	-10,710	-39,448
Year 5	-39,174		-6,726	-2,439	-39,174	1,445		-1,625	-4,540	-1,093	-1,093		-4,847	-5,415	-1,093	-39,448		-6,041	-746	-39,448
Year 15	-35,752		-2,852	2,529	-35,752	7,254		4,218	3,503	6,132	6,132		3,272	2,675	6,132	-36,251		-2,367	3,889	-36,251
Year 25	-32,848		-7	5,471	-32,848	10,255		8,022	7,433	9,278	9,278		7,036	5,345	9,278	-33,548		284	6,537	-33,548
Year 50	-30,462		2,246	7,714	-30,462	13,249		11,975	11,157	11,987	11,987		10,148	7,419	11,987	-31,338		2,375	8,554	-31,338
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-36,926	-36,926		0	0	-37,975	-37,975		0	0	-11,607	-11,607		0
Year 5	0				0	0	-1,623	-1,623		0	0	-2,730	-2,730		0	0	3,269	3,269		0
Year 15	0				0	0	4,271	4,271		0	0	3,155	3,155		0	0	5,755	5,755		0
Year 25	0				0	0	5,450	5,450		0	0	4,331	4,331		0	0	6,253	6,253		0
Year 50	0				0	0	6,334	6,334		0	0	5,214	5,214		0	0	6,626	6,626		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-48
SAM results showing wetted-area weighted relative response (square feet) at Site RM 19.4R

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-4,910		139	4,276		201		-845	-4,896		-821		-1,096	-3,072		-4,887		410	4,933	
Year 5	-4,910		1,204	9,599		3,614		1,872	6,442		2,875		2,939	9,292		-4,887		1,568	10,374	
Year 15	-4,037		2,101	11,483		4,781		3,548	10,773		4,455		5,121	12,851		-4,063		2,404	12,148	
Year 25	-3,290		2,725	12,262		5,405		4,678	12,659		5,233		6,083	13,778		-3,367		2,966	12,824	
Year 50	-2,670		3,208	12,848		6,045		5,861	14,351		5,935		6,864	14,480		-2,799		3,400	13,332	
Central Valley fall-run chinook salmon																				
Year 0	0		0	0				0	0		0			0		0			0	
Year 1	-4,910		139	4,276				-845	-4,896		-821			-3,072		-4,887			4,933	
Year 5	-4,910		1,204	9,599				1,872	6,442		2,875			9,292		-4,887			10,374	
Year 15	-4,037		2,101	11,483				3,548	10,773		4,455			12,851		-4,063			12,148	
Year 25	-3,290		2,725	12,262				4,678	12,659		5,233			13,778		-3,367			12,824	
Year 50	-2,670		3,208	12,848				5,861	14,351		5,935			14,480		-2,799			13,332	
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0	0					0	
Year 1	-4,910			4,276		201			-4,896		-821		-1,096	-3,072					4,933	
Year 5	-4,910			9,599		3,614			6,442		2,875		2,939	9,292					10,374	
Year 15	-4,037			11,483		4,781			10,773		4,455		5,121	12,851					12,148	
Year 25	-3,290			12,262		5,405			12,659		5,233		6,083	13,778					12,824	
Year 50	-2,670			12,848		6,045			14,351		5,935		6,864	14,480					13,332	
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-4,910		139	4,276		201		-845	-4,896		-821		-1,096	-3,072		-4,887		410		
Year 5	-4,910		1,204	9,599		3,614		1,872	6,442		2,875		2,939	9,292		-4,887		1,568		
Year 15	-4,037		2,101	11,483		4,781		3,548	10,773		4,455		5,121	12,851		-4,063		2,404		
Year 25	-3,290		2,725	12,262		5,405		4,678	12,659		5,233		6,083	13,778		-3,367		2,966		
Year 50	-2,670		3,208	12,848		6,045		5,861	14,351		5,935		6,864	14,480		-2,799		3,400		
Central Valley steelhead																				
Year 0	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
Year 1	-7,356		32	2,758	-7,356	1,373		-1,511	-4,677	811	811		-1,916	-3,895	811	-7,174		467	3,487	-7,174
Year 5	-7,356		1,663	6,932	-7,356	8,295		2,657	4,240	8,272	8,272		3,722	5,736	8,272	-7,174		2,191	7,732	-7,174
Year 15	-6,266		2,948	8,516	-6,266	10,617		4,899	7,362	10,931	10,931		6,487	8,532	10,931	-6,180		3,384	9,198	-6,180
Year 25	-5,353		3,835	9,335	-5,353	11,794		6,324	8,837	12,033	12,033		7,689	9,383	12,033	-5,353		4,184	9,913	-5,353
Year 50	-4,619		4,529	9,957	-4,619	12,963		7,794	10,223	12,971	12,971		8,676	10,040	12,971	-4,692		4,807	10,455	-4,692
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-3,026	-3,026		0	0	-3,314	-3,314		0	0	4,806	4,806		0
Year 5	0				0	0	11,177	11,177		0	0	10,869	10,869		0	0	10,969	10,969		0
Year 15	0				0	0	13,548	13,548		0	0	13,237	13,237		0	0	11,999	11,999		0
Year 25	0				0	0	14,023	14,023		0	0	13,711	13,711		0	0	12,205	12,205		0
Year 50	0				0	0	14,378	14,378		0	0	14,066	14,066		0	0	12,360	12,360		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-49
SAM results showing wetted-area weighted relative response (square feet) at Site RM 22.7R

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-3,123		-252	495		-1,245		-784	-3,596		-1,649		-1,073	-3,029		-3,135		-175	676	
Year 5	-3,123		161	2,480		32		245	660		-273		450	1,589		-3,135		255	2,688	
Year 15	-2,821		464	3,128		469		879	2,282		315		1,269	2,913		-2,832		562	3,340	
Year 25	-2,566		670	3,374		702		1,305	2,987		603		1,630	3,257		-2,576		767	3,587	
Year 50	-2,358		828	3,559		941		1,752	3,620		863		1,922	3,518		-2,368		926	3,773	
Central Valley fall-run chinook salmon																				
Year 0	0		0					0	0		0			0		0				
Year 1	-3,123		-252					-784	-3,596		-1,649			-3,029		-3,135				
Year 5	-3,123		161					245	660		-273			1,589		-3,135				
Year 15	-2,821		464					879	2,282		315			2,913		-2,832				
Year 25	-2,566		670					1,305	2,987		603			3,257		-2,576				
Year 50	-2,358		828					1,752	3,620		863			3,518		-2,368				
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0							
Year 1	-3,123			495		-1,245			-3,596		-1,649		-1,073							
Year 5	-3,123			2,480		32			660		-273		450							
Year 15	-2,821			3,128		469			2,282		315		1,269							
Year 25	-2,566			3,374		702			2,987		603		1,630							
Year 50	-2,358			3,559		941			3,620		863		1,922							
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-3,123		-252	495		-1,245		-784	-3,596		-1,649		-1,073	-3,029		-3,135		-175		
Year 5	-3,123		161	2,480		32		245	660		-273		450	1,589		-3,135		255		
Year 15	-2,821		464	3,128		469		879	2,282		315		1,269	2,913		-2,832		562		
Year 25	-2,566		670	3,374		702		1,305	2,987		603		1,630	3,257		-2,576		767		
Year 50	-2,358		828	3,559		941		1,752	3,620		863		1,922	3,518		-2,368		926		
Central Valley steelhead																				
Year 0	0		0		0	0		0	0	0	0		0	0	0	0		0		0
Year 1	-5,513		-491		-5,513	-2,313		-1,271	-3,146	-2,604	-2,604		-1,640	-2,943	-2,604	-5,535		-370		-5,535
Year 5	-5,513		133		-5,513	278		303	199	175	175		482	652	175	-5,535		269		-5,535
Year 15	-5,149		569		-5,149	1,147		1,149	1,368	1,162	1,162		1,518	1,691	1,162	-5,170		707		-5,170
Year 25	-4,846		861		-4,846	1,587		1,685	1,919	1,571	1,571		1,967	2,007	1,571	-4,867		1,000		-4,867
Year 50	-4,605		1,088		-4,605	2,024		2,239	2,437	1,918	1,918		2,336	2,250	1,918	-4,626		1,227		-4,626
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-3,818	-3,818		0	0	-4,020	-4,020		0	0	-131	-131		0
Year 5	0				0	0	1,515	1,515		0	0	1,283	1,283		0	0	2,147	2,147		0
Year 15	0				0	0	2,405	2,405		0	0	2,168	2,168		0	0	2,528	2,528		0
Year 25	0				0	0	2,583	2,583		0	0	2,345	2,345		0	0	2,604	2,604		0
Year 50	0				0	0	2,717	2,717		0	0	2,478	2,478		0	0	2,661	2,661		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-50
SAM results showing wetted-area weighted relative response (square feet) at Site RM 33.0R

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-6,300		-1,000	-4,059		-145		2,628	6,777		-1,302		2,272	5,234		-6,327		-728	-1,470	
Year 5	-6,300		-764	-1,967		3,802		5,974	20,286		3,060		7,076	20,587		-6,327		-708	-1,426	
Year 15	-4,965		-304	-436		5,210		8,287	26,019		5,220		10,920	26,620		-4,990		-283	-238	
Year 25	-3,771		53	584		5,981		9,930	28,747		6,366		12,884	28,489		-3,796		67	712	
Year 50	-2,720		336	1,353		6,776		11,683	31,260		7,437		14,515	29,911		-2,743		345	1,429	
Central Valley fall-run chinook salmon																				
Year 0	0		0					0	0		0			0		0				
Year 1	-6,300		-1,000					2,628	6,777		-1,302			5,234		-6,327				
Year 5	-6,300		-764					5,974	20,286		3,060			20,587		-6,327				
Year 15	-4,965		-304					8,287	26,019		5,220			26,620		-4,990				
Year 25	-3,771		53					9,930	28,747		6,366			28,489		-3,796				
Year 50	-2,720		336					11,683	31,260		7,437			29,911		-2,743				
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0							
Year 1	-6,300			-4,059		-145			6,777		-1,302		2,272							
Year 5	-6,300			-1,967		3,802			20,286		3,060		7,076							
Year 15	-4,965			-436		5,210			26,019		5,220		10,920							
Year 25	-3,771			584		5,981			28,747		6,366		12,884							
Year 50	-2,720			1,353		6,776			31,260		7,437		14,515							
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-6,300		-1,000	-4,059		-145		2,628	6,777		-1,302		2,272	5,234		-6,327		-728		
Year 5	-6,300		-764	-1,967		3,802		5,974	20,286		3,060		7,076	20,587		-6,327		-708		
Year 15	-4,965		-304	-436		5,210		8,287	26,019		5,220		10,920	26,620		-4,990		-283		
Year 25	-3,771		53	584		5,981		9,930	28,747		6,366		12,884	28,489		-3,796		67		
Year 50	-2,720		336	1,353		6,776		11,683	31,260		7,437		14,515	29,911		-2,743		345		
Central Valley steelhead																				
Year 0	0		0		0	0		0	0	0	0		0	0	0	0		0		0
Year 1	-11,323		-1,837		-11,323	459		4,206	5,347	-1,436	-1,436		3,473	3,429	-1,436	-11,366		-1,136		-11,366
Year 5	-11,323		-1,261		-11,323	8,435		9,292	16,011	7,374	7,374		10,262	15,375	7,374	-11,366		-1,116		-11,366
Year 15	-9,391		-351		-9,391	11,286		12,332	20,117	11,242	11,242		14,995	20,077	11,242	-9,432		-299		-9,432
Year 25	-7,739		347		-7,739	12,788		14,361	22,193	13,002	13,002		17,338	21,760	13,002	-7,780		381		-7,780
Year 50	-6,368		904		-6,368	14,292		16,486	24,178	14,525	14,525		19,294	23,073	14,525	-6,408		924		-6,408
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-2,953	-2,953		0	0	-3,372	-3,372		0	0	-10,631	-10,631		0
Year 5	0				0	0	14,475	14,475		0	0	14,002	14,002		0	0	-10,631	-10,631		0
Year 15	0				0	0	17,385	17,385		0	0	16,902	16,902		0	0	-10,631	-10,631		0
Year 25	0				0	0	17,967	17,967		0	0	17,482	17,482		0	0	-10,631	-10,631		0
Year 50	0				0	0	18,403	18,403		0	0	17,917	17,917		0	0	-10,631	-10,631		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-51
SAM results showing wetted-area weighted relative response (square feet) at Site RM 33.3R

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-4,446		-452	-979		-124		2,014	5,312		-1,061		2,213	5,974		-4,458		-236	866	
Year 5	-4,446		-259	540		2,584		4,432	14,713		1,905		5,761	16,455		-4,458		-220	898	
Year 15	-3,655		4	1,286		3,531		6,015	18,492		3,278		8,127	19,961		-3,665		15	1,398	
Year 25	-2,963		201	1,732		4,044		7,112	20,214		3,988		9,257	20,954		-2,971		206	1,795	
Year 50	-2,370		355	2,068		4,571		8,272	21,779		4,648		10,186	21,707		-2,376		356	2,095	
Central Valley fall-run chinook salmon																				
Year 0	0		0					0	0		0			0		0				
Year 1	-4,446		-452					2,014	5,312		-1,061			5,974		-4,458				
Year 5	-4,446		-259					4,432	14,713		1,905			16,455		-4,458				
Year 15	-3,655		4					6,015	18,492		3,278			19,961		-3,665				
Year 25	-2,963		201					7,112	20,214		3,988			20,954		-2,971				
Year 50	-2,370		355					8,272	21,779		4,648			21,707		-2,376				
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0							
Year 1	-4,446			-979		-124			5,312		-1,061		2,213							
Year 5	-4,446			540		2,584			14,713		1,905		5,761							
Year 15	-3,655			1,286		3,531			18,492		3,278		8,127							
Year 25	-2,963			1,732		4,044			20,214		3,988		9,257							
Year 50	-2,370			2,068		4,571			21,779		4,648		10,186							
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-4,446		-452	-979		-124		2,014	5,312		-1,061		2,213	5,974		-4,458		-236		
Year 5	-4,446		-259	540		2,584		4,432	14,713		1,905		5,761	16,455		-4,458		-220		
Year 15	-3,655		4	1,286		3,531		6,015	18,492		3,278		8,127	19,961		-3,665		15		
Year 25	-2,963		201	1,732		4,044		7,112	20,214		3,988		9,257	20,954		-2,971		206		
Year 50	-2,370		355	2,068		4,571		8,272	21,779		4,648		10,186	21,707		-2,376		356		
Central Valley steelhead																				
Year 0	0		0		0	0		0	0	0	0		0	0	0	0		0		0
Year 1	-7,354		-831		-7,354	368		3,166	4,292	-756	-756		3,233	4,152	-756	-7,374		-293		-7,374
Year 5	-7,354		-379		-7,354	5,851		6,789	11,663	5,231	5,231		8,118	12,270	5,231	-7,374		-278		-7,374
Year 15	-6,294		138		-6,294	7,753		8,849	14,376	7,615	7,615		11,009	15,031	7,615	-6,312		167		-6,312
Year 25	-5,398		518		-5,398	8,736		10,192	15,703	8,657	8,657		12,358	15,948	8,657	-5,412		534		-5,412
Year 50	-4,664		819		-4,664	9,717		11,587	16,962	9,555	9,555		13,473	16,660	9,555	-4,677		825		-4,677
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	783	783		0	0	726	726		0	0	-5,115	-5,115		0
Year 5	0				0	0	12,744	12,744		0	0	12,666	12,666		0	0	-5,115	-5,115		0
Year 15	0				0	0	14,741	14,741		0	0	14,659	14,659		0	0	-5,115	-5,115		0
Year 25	0				0	0	15,140	15,140		0	0	15,058	15,058		0	0	-5,115	-5,115		0
Year 50	0				0	0	15,440	15,440		0	0	15,357	15,357		0	0	-5,115	-5,115		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-52
SAM results showing wetted-area weighted relative response (square feet) at Site RM 43.7R

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-19,123		-1,138	9,817		-756		-3,440	-20,482		-4,666		-6,356	-17,291		-19,460		-1,087	10,517	
Year 5	-19,123		2,171	28,005		11,567		7,068	21,361		8,667		8,930	28,575		-19,460		2,458	29,136	
Year 15	-15,579		5,954	36,030		15,833		13,760	37,852		14,698		18,523	43,318		-15,984		6,162	36,935	
Year 25	-12,476		8,723	39,968		18,128		18,343	45,223		17,783		23,006	47,421		-12,955		8,838	40,638	
Year 50	-9,814		10,892	42,933		20,486		23,170	51,888		20,634		26,678	50,529		-10,373		10,929	43,426	
Central Valley fall-run chinook salmon																				
Year 0	0		0					0	0		0			0		0				
Year 1	-19,123		-1,138					-3,440	-20,482		-4,666			-17,291		-19,460				
Year 5	-19,123		2,171					7,068	21,361		8,667			28,575		-19,460				
Year 15	-15,579		5,954					13,760	37,852		14,698			43,318		-15,984				
Year 25	-12,476		8,723					18,343	45,223		17,783			47,421		-12,955				
Year 50	-9,814		10,892					23,170	51,888		20,634			50,529		-10,373				
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0							
Year 1	-19,123			9,817		-756			-20,482		-4,666		-6,356							
Year 5	-19,123			28,005		11,567			21,361		8,667		8,930							
Year 15	-15,579			36,030		15,833			37,852		14,698		18,523							
Year 25	-12,476			39,968		18,128			45,223		17,783		23,006							
Year 50	-9,814			42,933		20,486			51,888		20,634		26,678							
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-19,123		-1,138	9,817		-756		-3,440	-20,482		-4,666		-6,356	-17,291		-19,460		-1,087		
Year 5	-19,123		2,171	28,005		11,567		7,068	21,361		8,667		8,930	28,575		-19,460		2,458		
Year 15	-15,579		5,954	36,030		15,833		13,760	37,852		14,698		18,523	43,318		-15,984		6,162		
Year 25	-12,476		8,723	39,968		18,128		18,343	45,223		17,783		23,006	47,421		-12,955		8,838		
Year 50	-9,814		10,892	42,933		20,486		23,170	51,888		20,634		26,678	50,529		-10,373		10,929		
Central Valley steelhead																				
Year 0	0		0		0	0		0	0	0	0		0	0	0	0		0		0
Year 1	-31,504		-2,335		-31,504	1,618		-6,003	-18,721	-2,324	-2,324		-9,939	-18,868	-2,324	-31,671		-2,179		-31,671
Year 5	-31,504		2,903		-31,504	26,591		9,858	14,077	24,589	24,589		11,234	16,712	24,589	-31,671		3,302		-31,671
Year 15	-26,740		8,343		-26,740	35,116		18,644	25,870	34,963	34,963		23,100	28,256	34,963	-27,066		8,609		-27,066
Year 25	-22,707		12,295		-22,707	39,484		24,310	31,550	39,435	39,435		28,521	31,998	39,435	-23,175		12,423		-23,175
Year 50	-19,404		15,418		-19,404	43,838		30,182	36,919	43,280	43,280		32,996	34,900	43,280	-19,998		15,429		-19,998
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-18,174	-18,174		0	0	-18,149	-18,149		0	0	11,322	11,322		0
Year 5	0				0	0	34,694	34,694		0	0	34,226	34,226		0	0	33,144	33,144		0
Year 15	0				0	0	43,521	43,521		0	0	42,970	42,970		0	0	36,792	36,792		0
Year 25	0				0	0	45,286	45,286		0	0	44,719	44,719		0	0	37,521	37,521		0
Year 50	0				0	0	46,610	46,610		0	0	46,030	46,030		0	0	38,068	38,068		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-53
SAM results showing wetted-area weighted relative response (square feet) at Site RM 44.7R

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-48,798		-15,727	-45,809		-18,865		-8,834	-45,328		-25,252		-10,847	-33,236		-49,000		-15,884	-46,068	
Year 5	-48,798		-15,728	-45,809		1,167		10,222	25,324		-3,648		17,326	43,521		-49,000		-15,741	-45,823	
Year 15	-43,897		-14,466	-43,858		8,024		21,980	52,080		5,623		32,704	65,491		-44,105		-14,463	-43,862	
Year 25	-39,735		-13,436	-42,293		11,687		29,913	63,699		10,200		39,515	71,157		-39,951		-13,434	-42,314	
Year 50	-36,310		-12,638	-41,115		15,444		38,223	74,149		14,333		45,046	75,440		-36,540		-12,638	-41,148	
Central Valley fall-run chinook salmon																				
Year 0	0		0					0	0		0			0		0				
Year 1	-48,798		-15,727					-8,834	-45,328		-25,252			-33,236		-49,000				
Year 5	-48,798		-15,728					10,222	25,324		-3,648			43,521		-49,000				
Year 15	-43,897		-14,466					21,980	52,080		5,623			65,491		-44,105				
Year 25	-39,735		-13,436					29,913	63,699		10,200			71,157		-39,951				
Year 50	-36,310		-12,638					38,223	74,149		14,333			75,440		-36,540				
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0							
Year 1	-48,798			-45,809		-18,865			-45,328		-25,252		-10,847							
Year 5	-48,798			-45,809		1,167			25,324		-3,648		17,326							
Year 15	-43,897			-43,858		8,024			52,080		5,623		32,704							
Year 25	-39,735			-42,293		11,687			63,699		10,200		39,515							
Year 50	-36,310			-41,115		15,444			74,149		14,333		45,046							
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-48,798		-15,727	-45,809		-18,865		-8,834	-45,328		-25,252		-10,847	-33,236		-49,000		-15,884		
Year 5	-48,798		-15,728	-45,809		1,167		10,222	25,324		-3,648		17,326	43,521		-49,000		-15,741		
Year 15	-43,897		-14,466	-43,858		8,024		21,980	52,080		5,623		32,704	65,491		-44,105		-14,463		
Year 25	-39,735		-13,436	-42,293		11,687		29,913	63,699		10,200		39,515	71,157		-39,951		-13,434		
Year 50	-36,310		-12,638	-41,115		15,444		38,223	74,149		14,333		45,046	75,440		-36,540		-12,638		
Central Valley steelhead																				
Year 0	0		0		0	0		0	0	0	0		0	0	0	0		0		0
Year 1	-86,034		-27,082		-86,034	-34,834		-14,592	-37,799	-39,681	-39,681		-17,513	-32,177	-39,681	-86,306		-27,213		-86,306
Year 5	-86,034		-27,083		-86,034	5,800		13,481	17,212	3,928	3,928		20,308	27,018	3,928	-86,306		-27,088		-86,306
Year 15	-80,033		-24,678		-80,033	19,441		28,590	36,474	19,546	19,546		39,009	44,310	19,546	-80,328		-24,676		-80,328
Year 25	-75,023		-22,704		-75,023	26,352		38,196	45,573	26,041	26,041		47,170	49,588	26,041	-75,342		-22,710		-75,342
Year 50	-71,006		-21,160		-71,006	33,221		48,107	54,128	31,570	31,570		53,877	53,663	31,570	-71,347		-21,173		-71,347
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-45,361	-45,361		0	0	-45,120	-45,120		0	0	-71,820	-71,820		0
Year 5	0				0	0	43,419	43,419		0	0	43,174	43,174		0	0	-71,820	-71,820		0
Year 15	0				0	0	58,242	58,242		0	0	57,915	57,915		0	0	-71,820	-71,820		0
Year 25	0				0	0	61,206	61,206		0	0	60,864	60,864		0	0	-71,820	-71,820		0
Year 50	0				0	0	63,429	63,429		0	0	63,075	63,075		0	0	-71,820	-71,820		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-54
SAM results showing wetted-area weighted relative response (square feet) at Site RM 47.0L

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-12,830		-3,584	-16,448		1,159		-4,530	-27,149		-663		-7,753	-32,701		-14,010		-4,451	-18,628	
Year 5	-12,830		-3,585	-16,448		13,749		4,960	13,986		12,961		5,173	12,939		-14,010		-4,368	-18,481	
Year 15	-7,976		-1,246	-10,677		18,554		12,166	32,049		20,256		16,560	32,083		-9,160		-2,029	-12,896	
Year 25	-3,841		659	-6,054		21,931		18,384	41,142		24,143		22,473	38,216		-5,039		-133	-8,437	
Year 50	-427		2,132	-2,579		27,174		26,758	49,881		27,585		27,204	42,846		-1,649		1,330	-5,086	
Central Valley fall-run chinook salmon																				
Year 0	0		0					0	0		0			0		0				
Year 1	-12,830		-3,584					-4,530	-27,149		-663			-32,701		-14,010				
Year 5	-12,830		-3,585					4,960	13,986		12,961			12,939		-14,010				
Year 15	-7,976		-1,246					12,166	32,049		20,256			32,083		-9,160				
Year 25	-3,841		659					18,384	41,142		24,143			38,216		-5,039				
Year 50	-427		2,132					26,758	49,881		27,585			42,846		-1,649				
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0							
Year 1	-12,830			-16,448		1,159			-27,149		-663		-7,753							
Year 5	-12,830			-16,448		13,749			13,986		12,961		5,173							
Year 15	-7,976			-10,677		18,554			32,049		20,256		16,560							
Year 25	-3,841			-6,054		21,931			41,142		24,143		22,473							
Year 50	-427			-2,579		27,174			49,881		27,585		27,204							
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-12,830		-3,584	-16,448		1,159		-4,530	-27,149		-663		-7,753	-32,701		-14,010		-4,451		
Year 5	-12,830		-3,585	-16,448		13,749		4,960	13,986		12,961		5,173	12,939		-14,010		-4,368		
Year 15	-7,976		-1,246	-10,677		18,554		12,166	32,049		20,256		16,560	32,083		-9,160		-2,029		
Year 25	-3,841		659	-6,054		21,931		18,384	41,142		24,143		22,473	38,216		-5,039		-133		
Year 50	-427		2,132	-2,579		27,174		26,758	49,881		27,585		27,204	42,846		-1,649		1,330		
Central Valley steelhead																				
Year 0	0		0		0	0		0	0	0	0		0	0	0	0		0		0
Year 1	-23,516		-6,546		-23,516	4,785		-7,660	-24,559	1,663	1,663		-12,024	-29,549	1,663	-25,640		-7,875		-25,640
Year 5	-23,516		-6,547		-23,516	30,238		7,171	8,161	29,184	29,184		6,957	6,353	29,184	-25,640		-7,802		-25,640
Year 15	-16,293		-2,468		-16,293	39,878		16,812	21,346	42,127	42,127		21,432	21,419	42,127	-18,497		-3,745		-18,497
Year 25	-10,306		866		-10,306	46,030		24,574	28,717	48,105	48,105		28,718	26,946	48,105	-12,583		-440		-12,583
Year 50	-5,555		3,455		-5,555	54,250		34,892	36,575	53,087	53,087		34,597	31,185	53,087	-7,899		2,124		-7,899
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-34,403	-34,403		0	0	-35,391	-35,391		0	0	-24,403	-24,403		0
Year 5	0				0	0	18,625	18,625		0	0	16,350	16,350		0	0	-24,403	-24,403		0
Year 15	0				0	0	27,478	27,478		0	0	24,988	24,988		0	0	-24,403	-24,403		0
Year 25	0				0	0	29,249	29,249		0	0	26,716	26,716		0	0	-24,403	-24,403		0
Year 50	0				0	0	30,577	30,577		0	0	28,012	28,012		0	0	-24,403	-24,403		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-55
SAM results showing wetted-area weighted relative response (square feet) at Site RM 47.9R

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-29,972		-8,174	-23,703		-9,803		-4,307	-29,422		-14,307		-10,143	-30,849		-30,877		-8,488	-22,745	
Year 5	-29,972		-8,140	-23,682		3,998		8,140	18,460		706		7,871	22,113		-30,877		-8,363	-22,561	
Year 15	-25,642		-6,071	-19,819		8,810		16,223	37,540		7,675		19,981	39,943		-26,704		-6,398	-19,178	
Year 25	-21,805		-4,364	-16,721		11,410		21,804	46,180		11,285		25,789	45,013		-23,029		-4,790	-16,481	
Year 50	-18,461		-3,016	-14,384		14,083		27,700	54,031		14,644		30,561	48,858		-19,853		-3,525	-14,447	
Central Valley fall-run chinook salmon																				
Year 0	0		0					0	0		0			0		0				
Year 1	-29,972		-8,174					-4,307	-29,422		-14,307			-30,849		-30,877				
Year 5	-29,972		-8,140					8,140	18,460		706			22,113		-30,877				
Year 15	-25,642		-6,071					16,223	37,540		7,675			39,943		-26,704				
Year 25	-21,805		-4,364					21,804	46,180		11,285			45,013		-23,029				
Year 50	-18,461		-3,016					27,700	54,031		14,644			48,858		-19,853				
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0							
Year 1	-29,972			-23,703		-9,803			-29,422		-14,307		-10,143							
Year 5	-29,972			-23,682		3,998			18,460		706		7,871							
Year 15	-25,642			-19,819		8,810			37,540		7,675		19,981							
Year 25	-21,805			-16,721		11,410			46,180		11,285		25,789							
Year 50	-18,461			-14,384		14,083			54,031		14,644		30,561							
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-29,972		-8,174	-23,703		-9,803		-4,307	-29,422		-14,307		-10,143	-30,849		-30,877		-8,488		
Year 5	-29,972		-8,140	-23,682		3,998		8,140	18,460		706		7,871	22,113		-30,877		-8,363		
Year 15	-25,642		-6,071	-19,819		8,810		16,223	37,540		7,675		19,981	39,943		-26,704		-6,398		
Year 25	-21,805		-4,364	-16,721		11,410		21,804	46,180		11,285		25,789	45,013		-23,029		-4,790		
Year 50	-18,461		-3,016	-14,384		14,083		27,700	54,031		14,644		30,561	48,858		-19,853		-3,525		
Central Valley steelhead																				
Year 0	0		0		0	0		0	0	0	0		0	0	0	0		0		0
Year 1	-55,751		-13,896		-55,751	-17,741		-7,794	-24,607	-23,521	-23,521		-15,404	-28,740	-23,521	-56,622		-14,254		-56,622
Year 5	-55,751		-13,869		-55,751	10,210		10,785	12,885	6,786	6,786		9,365	12,264	6,786	-56,622		-14,152		-56,622
Year 15	-49,676		-10,346		-49,676	19,857		21,266	26,584	18,904	18,904		24,133	26,292	18,904	-50,899		-10,830		-50,899
Year 25	-44,505		-7,420		-44,505	24,832		28,077	33,258	24,212	24,212		31,038	30,970	24,212	-46,040		-8,086		-46,040
Year 50	-40,235		-5,091		-40,235	29,795		35,152	39,582	28,785	28,785		36,753	34,605	28,785	-42,047		-5,908		-42,047
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-33,225	-33,225		0	0	-35,427	-35,427		0	0	-32,351	-32,351		0
Year 5	0				0	0	27,635	27,635		0	0	24,951	24,951		0	0	-32,351	-32,351		0
Year 15	0				0	0	37,796	37,796		0	0	35,032	35,032		0	0	-32,351	-32,351		0
Year 25	0				0	0	39,828	39,828		0	0	37,048	37,048		0	0	-32,351	-32,351		0
Year 50	0				0	0	41,352	41,352		0	0	38,560	38,560		0	0	-32,351	-32,351		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-56
SAM results showing wetted-area weighted relative response (square feet) at Site RM 48.2R

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-19,566		-6,720	-23,945		-4,664		-1,294	-14,889		-7,694		-4,540	-15,769		-20,034		-7,025	-23,919	
Year 5	-19,566		-6,720	-23,945		5,765		8,315	21,588		3,653		9,169	24,602		-20,034		-6,968	-23,801	
Year 15	-16,224		-5,682	-21,214		9,406		14,576	36,177		9,009		18,801	38,736		-16,750		-5,949	-21,231	
Year 25	-13,252		-4,823	-19,021		11,375		18,905	42,799		11,800		23,494	42,838		-13,839		-5,114	-19,181	
Year 50	-10,650		-4,143	-17,367		13,399		23,480	48,819		14,404		27,361	45,950		-11,302		-4,453	-17,634	
Central Valley fall-run chinook salmon																				
Year 0	0		0					0	0		0			0		0				
Year 1	-19,566		-6,720					-1,294	-14,889		-7,694			-15,769		-20,034				
Year 5	-19,566		-6,720					8,315	21,588		3,653			24,602		-20,034				
Year 15	-16,224		-5,682					14,576	36,177		9,009			38,736		-16,750				
Year 25	-13,252		-4,823					18,905	42,799		11,800			42,838		-13,839				
Year 50	-10,650		-4,143					23,480	48,819		14,404			45,950		-11,302				
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0							
Year 1	-19,566			-23,945		-4,664			-14,889		-7,694		-4,540							
Year 5	-19,566			-23,945		5,765			21,588		3,653		9,169							
Year 15	-16,224			-21,214		9,406			36,177		9,009		18,801							
Year 25	-13,252			-19,021		11,375			42,799		11,800		23,494							
Year 50	-10,650			-17,367		13,399			48,819		14,404		27,361							
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-19,566		-6,720	-23,945		-4,664		-1,294	-14,889		-7,694		-4,540	-15,769		-20,034		-7,025		
Year 5	-19,566		-6,720	-23,945		5,765		8,315	21,588		3,653		9,169	24,602		-20,034		-6,968		
Year 15	-16,224		-5,682	-21,214		9,406		14,576	36,177		9,009		18,801	38,736		-16,750		-5,949		
Year 25	-13,252		-4,823	-19,021		11,375		18,905	42,799		11,800		23,494	42,838		-13,839		-5,114		
Year 50	-10,650		-4,143	-17,367		13,399		23,480	48,819		14,404		27,361	45,950		-11,302		-4,453		
Central Valley steelhead																				
Year 0	0		0		0	0		0	0	0	0		0	0	0	0		0		0
Year 1	-35,669		-11,992		-35,669	-7,329		-2,882	-12,814	-11,340	-11,340		-7,291	-15,536	-11,340	-36,208		-12,404		-36,208
Year 5	-35,669		-11,992		-35,669	13,791		11,419	15,730	11,569	11,569		11,595	15,716	11,569	-36,208		-12,350		-36,208
Year 15	-30,922		-9,993		-30,922	21,095		19,514	26,192	20,952	20,952		23,314	26,801	20,952	-31,597		-10,402		-31,597
Year 25	-26,874		-8,329		-26,874	24,866		24,781	31,298	25,101	25,101		28,872	30,561	25,101	-27,672		-8,788		-27,672
Year 50	-23,523		-7,002		-23,523	28,627		30,253	36,137	28,681	28,681		33,483	33,486	28,681	-24,431		-7,503		-24,431
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-16,702	-16,702		0	0	-17,356	-17,356		0	0	-32,331	-32,331		0
Year 5	0				0	0	29,735	29,735		0	0	28,620	28,620		0	0	-32,331	-32,331		0
Year 15	0				0	0	37,488	37,488		0	0	36,295	36,295		0	0	-32,331	-32,331		0
Year 25	0				0	0	39,039	39,039		0	0	37,831	37,831		0	0	-32,331	-32,331		0
Year 50	0				0	0	40,202	40,202		0	0	38,982	38,982		0	0	-32,331	-32,331		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-57
SAM results showing wetted-area weighted relative response (square feet) at Site RM 62.5R

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-5,192		-1,980	-8,394		-2,193		-791	-5,465		-3,028		-2,700	-7,166		-5,687		-2,394	-8,842	
Year 5	-5,192		-1,980	-8,394		504		1,647	3,921		-122		794	3,163		-5,687		-2,381	-8,813	
Year 15	-4,175		-1,668	-7,420		1,517		3,421	7,874		1,322		3,312	6,791		-4,705		-2,082	-7,960	
Year 25	-3,314		-1,414	-6,639		2,223		4,917	9,800		2,060		4,529	7,843		-3,878		-1,841	-7,280	
Year 50	-2,608		-1,218	-6,053		3,312		6,907	11,632		2,696		5,491	8,637		-3,207		-1,655	-6,769	
Central Valley fall-run chinook salmon																				
Year 0	0		0					0	0		0			0		0				
Year 1	-5,192		-1,980					-791	-5,465		-3,028			-7,166		-5,687				
Year 5	-5,192		-1,980					1,647	3,921		-122			3,163		-5,687				
Year 15	-4,175		-1,668					3,421	7,874		1,322			6,791		-4,705				
Year 25	-3,314		-1,414					4,917	9,800		2,060			7,843		-3,878				
Year 50	-2,608		-1,218					6,907	11,632		2,696			8,637		-3,207				
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0							
Year 1	-5,192			-8,394		-2,193			-5,465		-3,028		-2,700							
Year 5	-5,192			-8,394		504			3,921		-122		794							
Year 15	-4,175			-7,420		1,517			7,874		1,322		3,312							
Year 25	-3,314			-6,639		2,223			9,800		2,060		4,529							
Year 50	-2,608			-6,053		3,312			11,632		2,696		5,491							
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-5,192		-1,980	-8,394		-2,193		-791	-5,465		-3,028		-2,700	-7,166		-5,687		-2,394		
Year 5	-5,192		-1,980	-8,394		504		1,647	3,921		-122		794	3,163		-5,687		-2,381		
Year 15	-4,175		-1,668	-7,420		1,517		3,421	7,874		1,322		3,312	6,791		-4,705		-2,082		
Year 25	-3,314		-1,414	-6,639		2,223		4,917	9,800		2,060		4,529	7,843		-3,878		-1,841		
Year 50	-2,608		-1,218	-6,053		3,312		6,907	11,632		2,696		5,491	8,637		-3,207		-1,655		
Central Valley steelhead																				
Year 0	0		0		0	0		0	0	0	0		0	0	0	0		0		0
Year 1	-10,177		-3,526		-10,177	-4,147		-1,424	-4,628	-5,319	-5,319		-3,821	-6,593	-5,319	-11,013		-4,124		-11,013
Year 5	-10,177		-3,526		-10,177	1,311		2,221	2,730	549	549		997	1,405	549	-11,013		-4,112		-11,013
Year 15	-8,696		-2,916		-8,696	3,331		4,500	5,593	3,026	3,026		4,065	4,264	3,026	-9,620		-3,533		-9,620
Year 25	-7,471		-2,418		-7,471	4,602		6,298	7,154	4,116	4,116		5,513	5,233	4,116	-8,471		-3,063		-8,471
Year 50	-6,502		-2,032		-6,502	6,291		8,663	8,804	5,012	5,012		6,668	5,973	5,012	-7,566		-2,700		-7,566
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-6,530	-6,530		0	0	-8,284	-8,284		0	0	-11,542	-11,542		0
Year 5	0				0	0	5,442	5,442		0	0	3,475	3,475		0	0	-11,542	-11,542		0
Year 15	0				0	0	7,441	7,441		0	0	5,439	5,439		0	0	-11,542	-11,542		0
Year 25	0				0	0	7,841	7,841		0	0	5,831	5,831		0	0	-11,542	-11,542		0
Year 50	0				0	0	8,141	8,141		0	0	6,126	6,126		0	0	-11,542	-11,542		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-58
SAM results showing wetted-area weighted relative response (square feet) at Site RM 68.9L

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-6,058		-1,265	-8,108		2,256		2,261	-1,195		2,522		2,566	-104		-6,156		-1,368	-8,550	
Year 5	-6,058		-1,265	-8,108		9,968		8,712	25,043		10,968		11,192	29,548		-6,156		-1,339	-8,474	
Year 15	-2,858		-263	-4,468		12,990		13,972	37,409		15,778		20,175	44,006		-2,904		-316	-4,763	
Year 25	-112		556	-1,552		15,146		18,691	43,985		18,422		25,116	49,047		-114		518	-1,797	
Year 50	2,177		1,192	641		18,527		25,191	50,418		20,807		29,114	52,857		2,212		1,164	433	
Central Valley fall-run chinook salmon																				
Year 0	0		0					0	0		0			0		0				
Year 1	-6,058		-1,265					2,261	-1,195		2,522			-104		-6,156				
Year 5	-6,058		-1,265					8,712	25,043		10,968			29,548		-6,156				
Year 15	-2,858		-263					13,972	37,409		15,778			44,006		-2,904				
Year 25	-112		556					18,691	43,985		18,422			49,047		-114				
Year 50	2,177		1,192					25,191	50,418		20,807			52,857		2,212				
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0							
Year 1	-6,058			-8,108		2,256			-1,195		2,522		2,566							
Year 5	-6,058			-8,108		9,968			25,043		10,968		11,192							
Year 15	-2,858			-4,468		12,990			37,409		15,778		20,175							
Year 25	-112			-1,552		15,146			43,985		18,422		25,116							
Year 50	2,177			641		18,527			50,418		20,807		29,114							
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-6,058		-1,265	-8,108		2,256		2,261	-1,195		2,522		2,566	-104		-6,156		-1,368		
Year 5	-6,058		-1,265	-8,108		9,968		8,712	25,043		10,968		11,192	29,548		-6,156		-1,339		
Year 15	-2,858		-263	-4,468		12,990		13,972	37,409		15,778		20,175	44,006		-2,904		-316		
Year 25	-112		556	-1,552		15,146		18,691	43,985		18,422		25,116	49,047		-114		518		
Year 50	2,177		1,192	641		18,527		25,191	50,418		20,807		29,114	52,857		2,212		1,164		
Central Valley steelhead																				
Year 0	0		0		0	0		0	0	0	0		0	0	0	0		0		0
Year 1	-10,832		-2,608		-10,832	5,914		2,926	-683	6,439	6,439		3,383	104	6,439	-11,007		-2,774		-11,007
Year 5	-10,832		-2,609		-10,832	21,469		12,803	20,150	23,512	23,512		15,931	23,379	23,512	-11,007		-2,744		-11,007
Year 15	-5,925		-620		-5,925	27,603		19,660	29,060	32,300	32,300		27,043	34,541	32,300	-6,020		-718		-6,020
Year 25	-1,844		1,010		-1,844	31,607		25,372	34,250	36,506	36,506		32,932	38,903	36,506	-1,874		938		-1,874
Year 50	1,408		2,280		1,408	37,006		33,105	39,865	40,049	40,049		37,733	42,260	40,049	1,431		2,230		1,431
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-7,587	-7,587		0	0	-7,888	-7,888		0	0	-20,037	-20,037		0
Year 5	0				0	0	26,908	26,908		0	0	25,830	25,830		0	0	-20,037	-20,037		0
Year 15	0				0	0	32,667	32,667		0	0	31,460	31,460		0	0	-20,037	-20,037		0
Year 25	0				0	0	33,819	33,819		0	0	32,586	32,586		0	0	-20,037	-20,037		0
Year 50	0				0	0	34,682	34,682		0	0	33,430	33,430		0	0	-20,037	-20,037		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-59
SAM results showing wetted-area weighted relative response (square feet) at Site RM 78.0L

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-7,730		-2,741	-12,280		6,057		4,210	2,093		3,483		2,950	377		-8,694		-3,199	-12,468	
Year 5	-7,730		-2,741	-12,280		16,503		13,815	38,590		13,138		12,099	34,709		-8,694		-3,147	-12,355	
Year 15	-3,867		-1,565	-8,790		20,451		20,916	54,201		18,686		22,022	49,092		-4,931		-2,008	-9,193	
Year 25	-606		-610	-5,994		23,210		26,950	61,894		22,506		29,351	56,632		-1,770		-1,090	-6,673	
Year 50	2,053		124	-3,894		27,473		35,007	69,232		25,746		35,086	62,307		789		-386	-4,779	
Central Valley fall-run chinook salmon																				
Year 0	0		0					0	0		0			0		0				
Year 1	-7,730		-2,741					4,210	2,093		3,483			377		-8,694				
Year 5	-7,730		-2,741					13,815	38,590		13,138			34,709		-8,694				
Year 15	-3,867		-1,565					20,916	54,201		18,686			49,092		-4,931				
Year 25	-606		-610					26,950	61,894		22,506			56,632		-1,770				
Year 50	2,053		124					35,007	69,232		25,746			62,307		789				
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0							
Year 1	-7,730			-12,280		6,057			2,093		3,483		2,950							
Year 5	-7,730			-12,280		16,503			38,590		13,138		12,099							
Year 15	-3,867			-8,790		20,451			54,201		18,686		22,022							
Year 25	-606			-5,994		23,210			61,894		22,506		29,351							
Year 50	2,053			-3,894		27,473			69,232		25,746		35,086							
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-7,730		-2,741	-12,280		6,057		4,210	2,093		3,483		2,950	377		-8,694		-3,199		
Year 5	-7,730		-2,741	-12,280		16,503		13,815	38,590		13,138		12,099	34,709		-8,694		-3,147		
Year 15	-3,867		-1,565	-8,790		20,451		20,916	54,201		18,686		22,022	49,092		-4,931		-2,008		
Year 25	-606		-610	-5,994		23,210		26,950	61,894		22,506		29,351	56,632		-1,770		-1,090		
Year 50	2,053		124	-3,894		27,473		35,007	69,232		25,746		35,086	62,307		789		-386		
Central Valley steelhead																				
Year 0	0		0		0	0		0	0	0	0		0	0	0	0		0		0
Year 1	-13,399		-5,304		-13,399	13,637		5,494	3,640	9,965	9,965		3,245	867	9,965	-14,679		-6,024		-14,679
Year 5	-13,399		-5,304		-13,399	34,773		19,823	32,254	29,566	29,566		16,752	27,539	29,566	-14,679		-5,974		-14,679
Year 15	-7,856		-3,015		-7,856	42,663		28,912	43,535	39,170	39,170		28,825	38,824	39,170	-9,386		-3,775		-9,386
Year 25	-3,280		-1,148		-3,280	47,651		36,132	49,740	45,272	45,272		37,537	45,256	45,272	-5,025		-1,990		-5,025
Year 50	330		295		330	54,290		45,661	56,313	50,201	50,201		44,398	50,145	50,201	-1,595		-612		-1,595
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	17,570	17,570		0	0	17,634	17,634		0	0	-8,833	-8,833		0
Year 5	0				0	0	64,371	64,371		0	0	63,651	63,651		0	0	-8,833	-8,833		0
Year 15	0				0	0	72,185	72,185		0	0	71,334	71,334		0	0	-8,833	-8,833		0
Year 25	0				0	0	73,748	73,748		0	0	72,870	72,870		0	0	-8,833	-8,833		0
Year 50	0				0	0	74,920	74,920		0	0	74,023	74,023		0	0	-8,833	-8,833		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-60
SAM results showing cumulative bank-line weighted relative response (feet) at sites within RM 0-20

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-152		-26	2		-43		-32	-143		-67		-59	-142		-155		-20	32	
Year 5	-152		-4	120		21		19	72		4		16	97		-155		0	137	
Year 15	-133		17	167		44		52	158		36		64	175		-136		21	179	
Year 25	-116		32	188		56		75	197		52		87	197		-119		35	199	
Year 50	-101		44	205		68		99	232		68		105	213		-105		46	214	
Central Valley fall-run chinook salmon																				
Year 0	0		0	0				0	0		0			0		0			0	
Year 1	-152		-26	2				-32	-143		-67			-142		-155			32	
Year 5	-152		-4	120				19	72		4			97		-155			137	
Year 15	-133		17	167				52	158		36			175		-136			179	
Year 25	-116		32	188				75	197		52			197		-119			199	
Year 50	-101		44	205				99	232		68			213		-105			214	
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0	0					0	
Year 1	-152			2		-43			-143		-67		-59	-142					32	
Year 5	-152			120		21			72		4		16	97					137	
Year 15	-133			167		44			158		36		64	175					179	
Year 25	-116			188		56			197		52		87	197					199	
Year 50	-101			205		68			232		68		105	213					214	
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-152		-26	2		-43		-32	-143		-67		-59	-142		-155		-20		
Year 5	-152		-4	120		21		19	72		4		16	97		-155		0		
Year 15	-133		17	167		44		52	158		36		64	175		-136		21		
Year 25	-116		32	188		56		75	197		52		87	197		-119		35		
Year 50	-101		44	205		68		99	232		68		105	213		-105		46		
Central Valley steelhead																				
Year 0	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
Year 1	-275		-41	-34	-275	-79		-48	-134	-107	-107		-81	-148	-107	-277		-30	-7	-277
Year 5	-275		-6	61	-275	52		31	36	36	36		26	39	36	-277		1	76	-277
Year 15	-249		25	101	-249	98		75	98	92	92		86	100	92	-252		30	112	-252
Year 25	-227		47	123	-227	121		104	128	116	116		113	119	116	-231		51	132	-231
Year 50	-209		64	139	-209	144		134	156	136	136		136	135	136	-214		67	148	-214
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-235	-235		0	0	-246	-246		0	0	-51	-51		0
Year 5	0				0	0	37	37		0	0	27	27		0	0	71	71		0
Year 15	0				0	0	83	83		0	0	72	72		0	0	92	92		0
Year 25	0				0	0	92	92		0	0	81	81		0	0	96	96		0
Year 50	0				0	0	99	99		0	0	88	88		0	0	99	99		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-61
SAM results showing cumulative bank-line weighted relative response (feet) at sites within RM 20-80

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-687		-182	-585		-101		-48	-540		-205		-133	-540		-707		-192	-578	
Year 5	-687		-165	-487		307		311	863		239		367	1,015		-707		-173	-489	
Year 15	-546		-103	-337		455		557	1,441		458		739	1,581		-568		-113	-348	
Year 25	-424		-54	-229		544		744	1,714		576		935	1,767		-448		-66	-247	
Year 50	-321		-16	-147		660		969	1,969		683		1,092	1,907		-348		-29	-171	
Central Valley fall-run chinook salmon																				
Year 0	0		0					0	0		0			0		0				
Year 1	-687		-182					-48	-540		-205			-540		-707				
Year 5	-687		-165					311	863		239			1,015		-707				
Year 15	-546		-103					557	1,441		458			1,581		-568				
Year 25	-424		-54					744	1,714		576			1,767		-448				
Year 50	-321		-16					969	1,969		683			1,907		-348				
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0							
Year 1	-687			-585		-101			-540		-205		-133							
Year 5	-687			-487		307			863		239		367							
Year 15	-546			-337		455			1,441		458		739							
Year 25	-424			-229		544			1,714		576		935							
Year 50	-321			-147		660			1,969		683		1,092							
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-687		-182	-585		-101		-48	-540		-205		-133	-540		-707		-192		
Year 5	-687		-165	-487		307		311	863		239		367	1,015		-707		-173		
Year 15	-546		-103	-337		455		557	1,441		458		739	1,581		-568		-113		
Year 25	-424		-54	-229		544		744	1,714		576		935	1,767		-448		-66		
Year 50	-321		-16	-147		660		969	1,969		683		1,092	1,907		-348		-29		
Central Valley steelhead																				
Year 0	0		0		0	0		0	0	0	0		0	0	0	0		0		0
Year 1	-1,227		-325		-1,227	-131		-99	-459	-252	-252		-219	-524	-252	-1,253		-336		-1,253
Year 5	-1,227		-297		-1,227	695		440	643	646	646		482	684	646	-1,253		-309		-1,253
Year 15	-1,027		-189		-1,027	990		760	1,060	1,027	1,027		940	1,128	1,027	-1,060		-205		-1,060
Year 25	-860		-104		-860	1,158		989	1,275	1,206	1,206		1,174	1,294	1,206	-898		-123		-898
Year 50	-726		-37		-726	1,352		1,259	1,491	1,356	1,356		1,365	1,422	1,356	-767		-58		-767
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-599	-599		0	0	-643	-643		0	0	-898	-898		0
Year 5	0				0	0	1,192	1,192		0	0	1,166	1,166		0	0	-800	-800		0
Year 15	0				0	0	1,490	1,490		0	0	1,468	1,468		0	0	-784	-784		0
Year 25	0				0	0	1,550	1,550		0	0	1,528	1,528		0	0	-780	-780		0
Year 50	0				0	0	1,595	1,595		0	0	1,573	1,573		0	0	-778	-778		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-62
SAM results showing cumulative wetted-area weighted relative response (acres) at sites within RM 0-20

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-0.97		-0.16	0.01		-0.30		-0.21	-0.93		-0.45		-0.39	-0.92		-0.98		-0.13	0.19	
Year 5	-0.97		-0.03	0.76		0.13		0.14	0.50		0.02		0.11	0.67		-0.98		0.00	0.86	
Year 15	-0.85		0.11	1.06		0.28		0.36	1.08		0.23		0.43	1.18		-0.86		0.13	1.13	
Year 25	-0.74		0.21	1.19		0.36		0.51	1.34		0.34		0.58	1.33		-0.76		0.22	1.25	
Year 50	-0.65		0.28	1.30		0.45		0.67	1.57		0.44		0.71	1.44		-0.67		0.29	1.35	
Central Valley fall-run chinook salmon																				
Year 0	0		0	0				0	0		0			0		0			0	
Year 1	-0.97		-0.16	0.01				-0.21	-0.93		-0.45			-0.92		-0.98			0.19	
Year 5	-0.97		-0.03	0.76				0.14	0.50		0.02			0.67		-0.98			0.86	
Year 15	-0.85		0.11	1.06				0.36	1.08		0.23			1.18		-0.86			1.13	
Year 25	-0.74		0.21	1.19				0.51	1.34		0.34			1.33		-0.76			1.25	
Year 50	-0.65		0.28	1.30				0.67	1.57		0.44			1.44		-0.67			1.35	
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0	0					0	
Year 1	-0.97			0.01		-0.30			-0.93		-0.45		-0.39	-0.92					0.19	
Year 5	-0.97			0.76		0.13			0.50		0.02		0.11	0.67					0.86	
Year 15	-0.85			1.06		0.28			1.08		0.23		0.43	1.18					1.13	
Year 25	-0.74			1.19		0.36			1.34		0.34		0.58	1.33					1.25	
Year 50	-0.65			1.30		0.45			1.57		0.44		0.71	1.44					1.35	
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-0.97		-0.16	0.01		-0.30		-0.21	-0.93		-0.45		-0.39	-0.92		-0.98		-0.13		
Year 5	-0.97		-0.03	0.76		0.13		0.14	0.50		0.02		0.11	0.67		-0.98		0.00		
Year 15	-0.85		0.11	1.06		0.28		0.36	1.08		0.23		0.43	1.18		-0.86		0.13		
Year 25	-0.74		0.21	1.19		0.36		0.51	1.34		0.34		0.58	1.33		-0.76		0.22		
Year 50	-0.65		0.28	1.30		0.45		0.67	1.57		0.44		0.71	1.44		-0.67		0.29		
Central Valley steelhead																				
Year 0	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
Year 1	-1.76		-0.26	-0.23	-1.76	-0.54		-0.30	-0.87	-0.73	-0.73		-0.53	-0.97	-0.73	-1.76		-0.19	-0.05	-1.76
Year 5	-1.76		-0.04	0.38	-1.76	0.33		0.22	0.26	0.22	0.22		0.18	0.27	0.22	-1.76		0.00	0.47	-1.76
Year 15	-1.59		0.16	0.64	-1.59	0.63		0.51	0.67	0.59	0.59		0.58	0.67	0.59	-1.61		0.19	0.70	-1.61
Year 25	-1.45		0.30	0.78	-1.45	0.79		0.71	0.87	0.75	0.75		0.77	0.81	0.75	-1.47		0.32	0.83	-1.47
Year 50	-1.34		0.41	0.88	-1.34	0.94		0.90	1.06	0.89	0.89		0.92	0.91	0.89	-1.36		0.42	0.93	-1.36
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-1.61	-1.61		0	0	-1.67	-1.67		0	0	-0.34	-0.34		0
Year 5	0				0	0	0.21	0.21		0	0	0.14	0.14		0	0	0.43	0.43		0
Year 15	0				0	0	0.51	0.51		0	0	0.45	0.45		0	0	0.56	0.56		0
Year 25	0				0	0	0.57	0.57		0	0	0.51	0.51		0	0	0.59	0.59		0
Year 50	0				0	0	0.62	0.62		0	0	0.55	0.55		0	0	0.61	0.61		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Table I-63
SAM results showing cumulative wetted-area weighted relative response (acres) at sites within RM 20-80

Focus Fish Species and Scenario	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat	Adult Upstream Migration	Spawning and Incubation	Juvenile Rearing	Smolt Outmigration	Adult Habitat
Central Valley spring-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0	0	
Year 1	-3.75		-0.99	-3.06		-0.65		-0.30	-3.06		-1.23		-0.77	-2.95		-3.85		-1.03	-3.00	
Year 5	-3.75		-0.89	-2.52		1.60		1.69	4.68		1.17		1.97	5.46		-3.85		-0.93	-2.50	
Year 15	-3.02		-0.57	-1.75		2.41		3.03	7.85		2.34		3.96	8.47		-3.14		-0.62	-1.78	
Year 25	-2.40		-0.32	-1.21		2.89		4.05	9.34		2.97		4.98	9.43		-2.52		-0.37	-1.27	
Year 50	-1.87		-0.12	-0.80		3.49		5.24	10.71		3.53		5.81	10.16		-2.01		-0.17	-0.89	
Central Valley fall-run chinook salmon																				
Year 0	0		0					0	0		0			0		0				
Year 1	-3.75		-0.99					-0.30	-3.06		-1.23			-2.95		-3.85				
Year 5	-3.75		-0.89					1.69	4.68		1.17			5.46		-3.85				
Year 15	-3.02		-0.57					3.03	7.85		2.34			8.47		-3.14				
Year 25	-2.40		-0.32					4.05	9.34		2.97			9.43		-2.52				
Year 50	-1.87		-0.12					5.24	10.71		3.53			10.16		-2.01				
Central Valley late fall-run chinook salmon																				
Year 0	0			0		0			0		0		0							
Year 1	-3.75			-3.06		-0.65			-3.06		-1.23		-0.77							
Year 5	-3.75			-2.52		1.60			4.68		1.17		1.97							
Year 15	-3.02			-1.75		2.41			7.85		2.34		3.96							
Year 25	-2.40			-1.21		2.89			9.34		2.97		4.98							
Year 50	-1.87			-0.80		3.49			10.71		3.53		5.81							
Sacramento River winter-run chinook salmon																				
Year 0	0		0	0		0		0	0		0		0	0		0		0		
Year 1	-3.75		-0.99	-3.06		-0.65		-0.30	-3.06		-1.23		-0.77	-2.95		-3.85		-1.03		
Year 5	-3.75		-0.89	-2.52		1.60		1.69	4.68		1.17		1.97	5.46		-3.85		-0.93		
Year 15	-3.02		-0.57	-1.75		2.41		3.03	7.85		2.34		3.96	8.47		-3.14		-0.62		
Year 25	-2.40		-0.32	-1.21		2.89		4.05	9.34		2.97		4.98	9.43		-2.52		-0.37		
Year 50	-1.87		-0.12	-0.80		3.49		5.24	10.71		3.53		5.81	10.16		-2.01		-0.17		
Central Valley steelhead																				
Year 0	0		0		0	0		0	0	0	0		0	0	0	0		0		0
Year 1	-6.68		-1.76		-6.68	-0.91		-0.59	-2.61	-1.58	-1.58		-1.25	-2.89	-1.58	-6.83		-1.81		-6.83
Year 5	-6.68		-1.60		-6.68	3.64		2.39	3.47	3.27	3.27		2.57	3.64	3.27	-6.83		-1.65		-6.83
Year 15	-5.67		-1.04		-5.67	5.26		4.14	5.75	5.30	5.30		5.01	6.00	5.30	-5.84		-1.11		-5.84
Year 25	-4.82		-0.60		-4.82	6.16		5.37	6.92	6.24	6.24		6.24	6.87	6.24	-5.01		-0.68		-5.01
Year 50	-4.14		-0.25		-4.14	7.19		6.80	8.08	7.04	7.04		7.25	7.53	7.04	-4.34		-0.35		-4.34
Delta Smelt																				
Year 0	0				0	0	0	0		0	0	0	0		0	0	0	0		0
Year 1	0				0	0	-3.45	-3.45		0	0	-3.60	-3.60		0	0	-4.73	-4.73		0
Year 5	0				0	0	6.42	6.42		0	0	6.16	6.16		0	0	-4.17	-4.17		0
Year 15	0				0	0	8.07	8.07		0	0	7.79	7.79		0	0	-4.08	-4.08		0
Year 25	0				0	0	8.40	8.40		0	0	8.11	8.11		0	0	-4.06	-4.06		0
Year 50	0				0	0	8.64	8.64		0	0	8.36	8.36		0	0	-4.05	-4.05		0

Notes: 1 Dark shading represents seasons in which various life stages are not found in the modeled reach of the Sacramento River.
2 Results calculated from time-averaged relative responses (with minus without project) to changes in each of six habitat variables used in the SAM (Stillwater Sciences 2006).

Appendix I

Figures

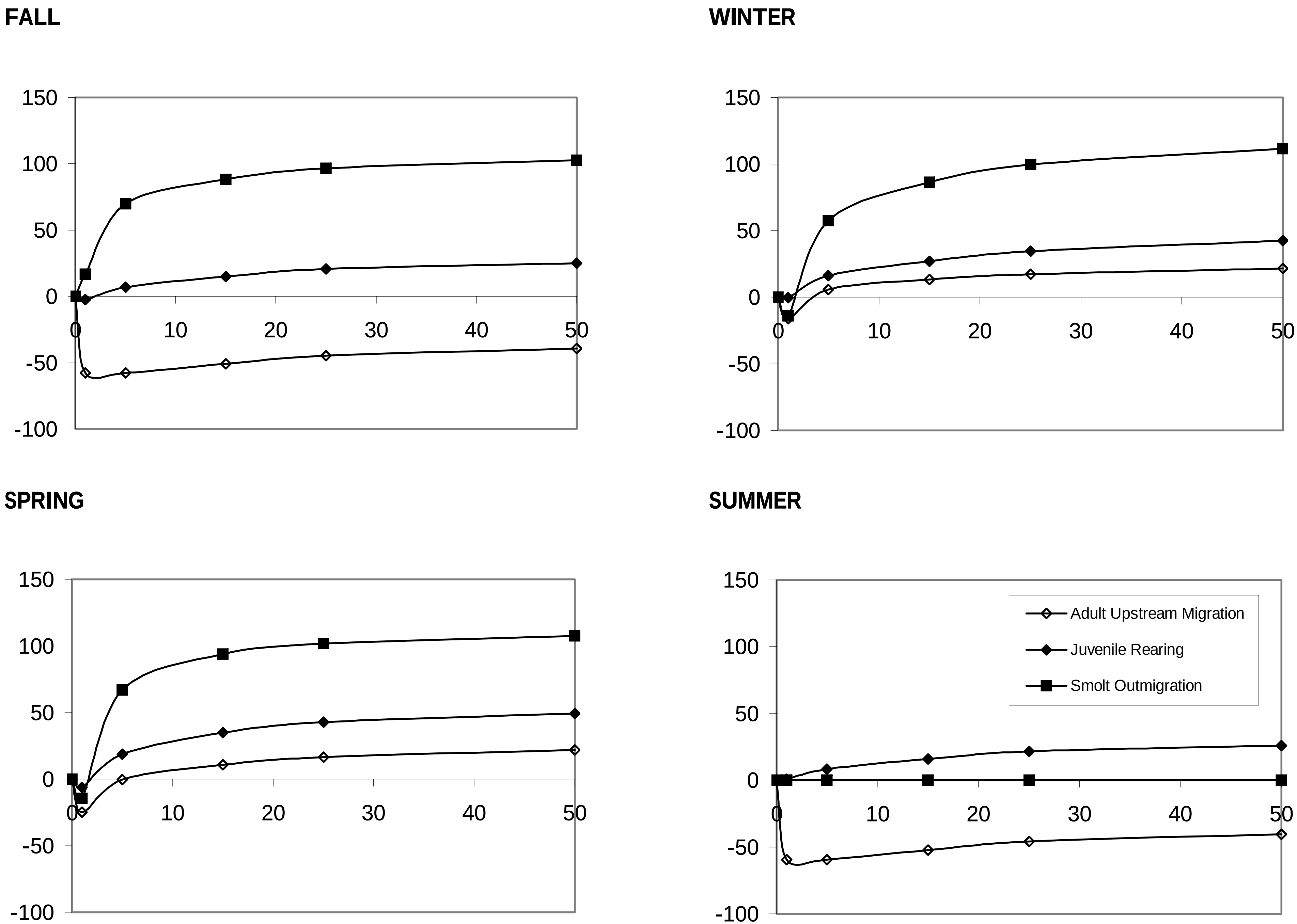


Figure I-1. **SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site RM 16.9L.**

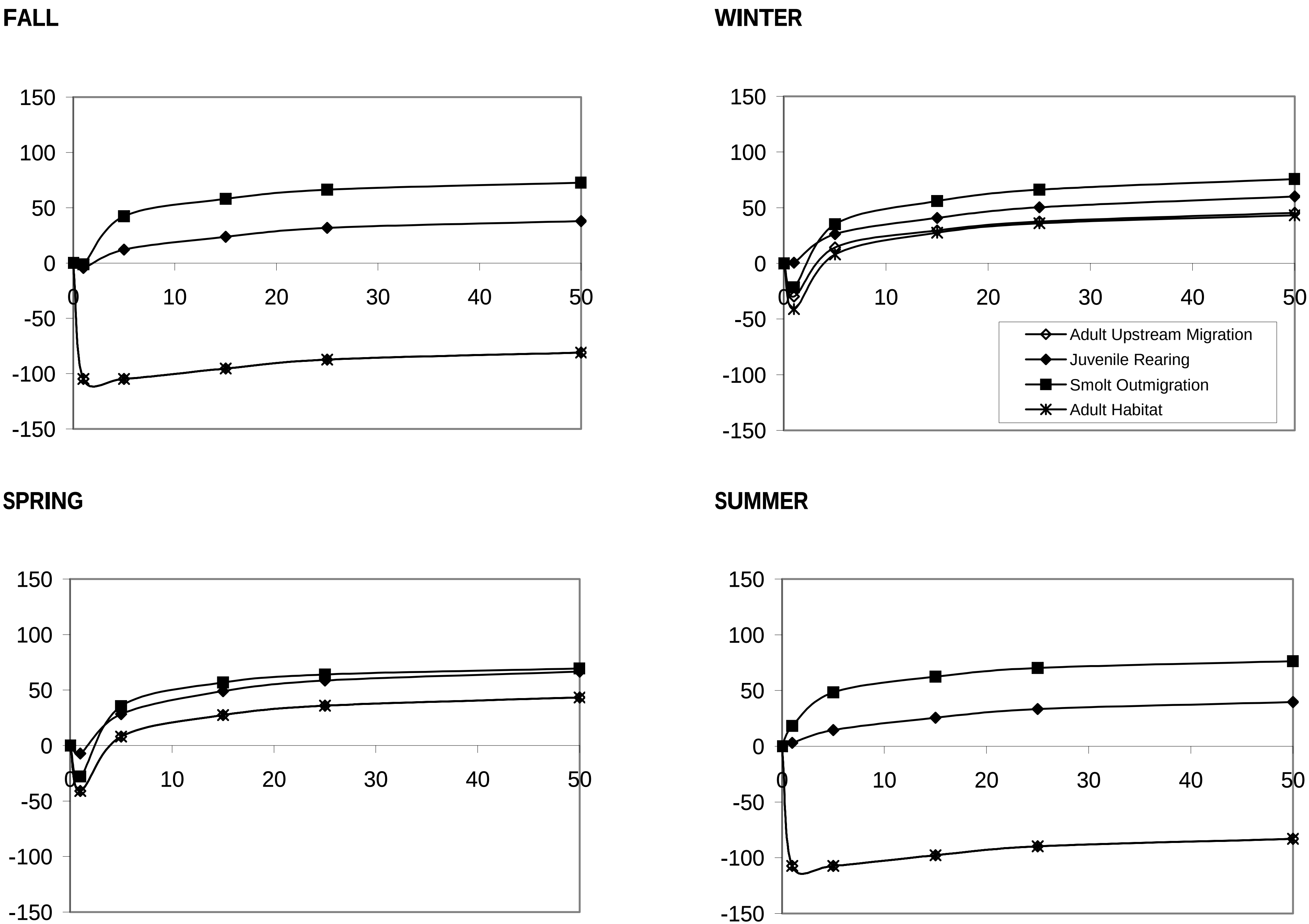


Figure I-2. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site RM 16.9L.

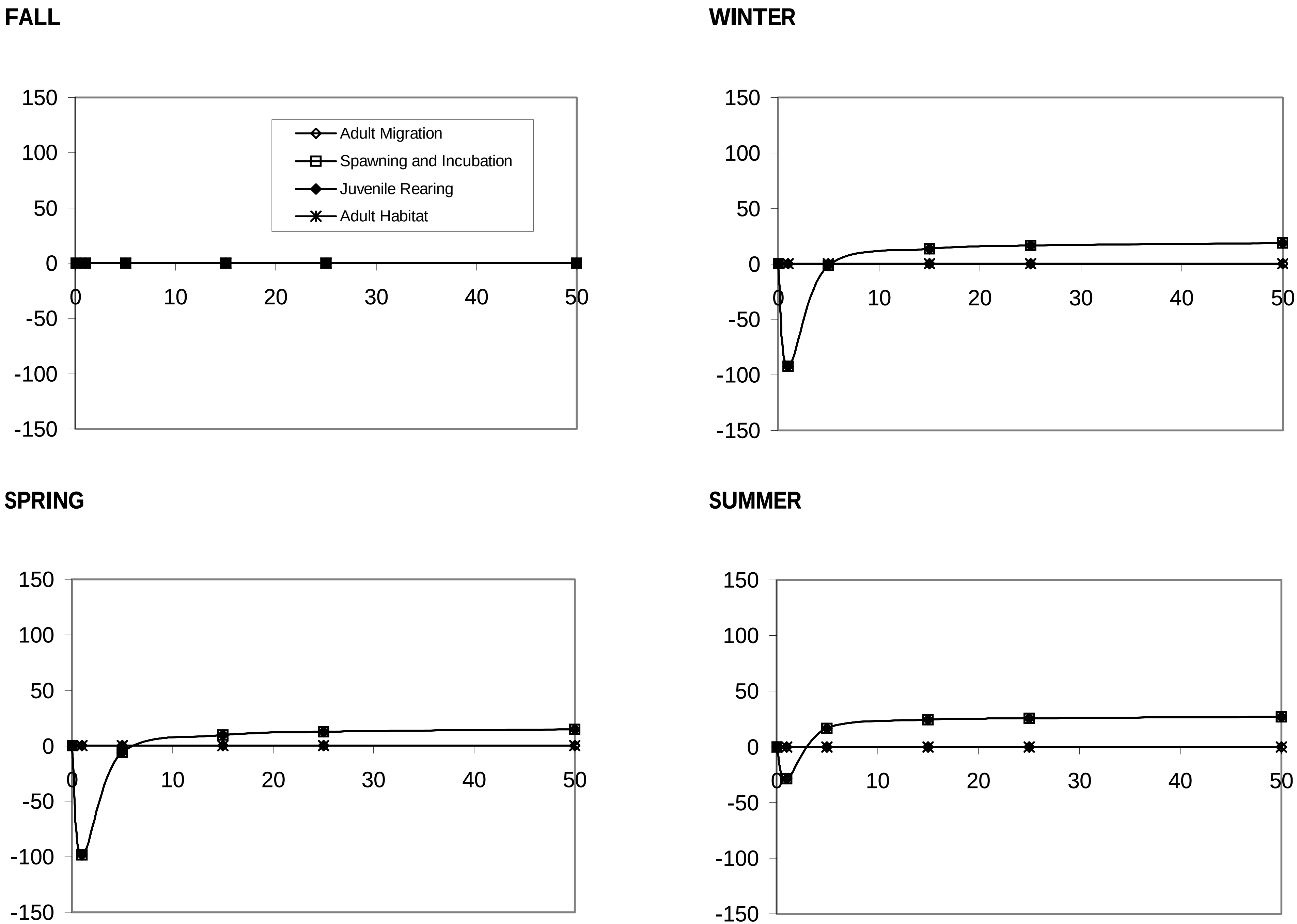


Figure I-3. SAM results showing bank-line weighted relative response (feet) for Delta smelt at Site RM 16.9L.

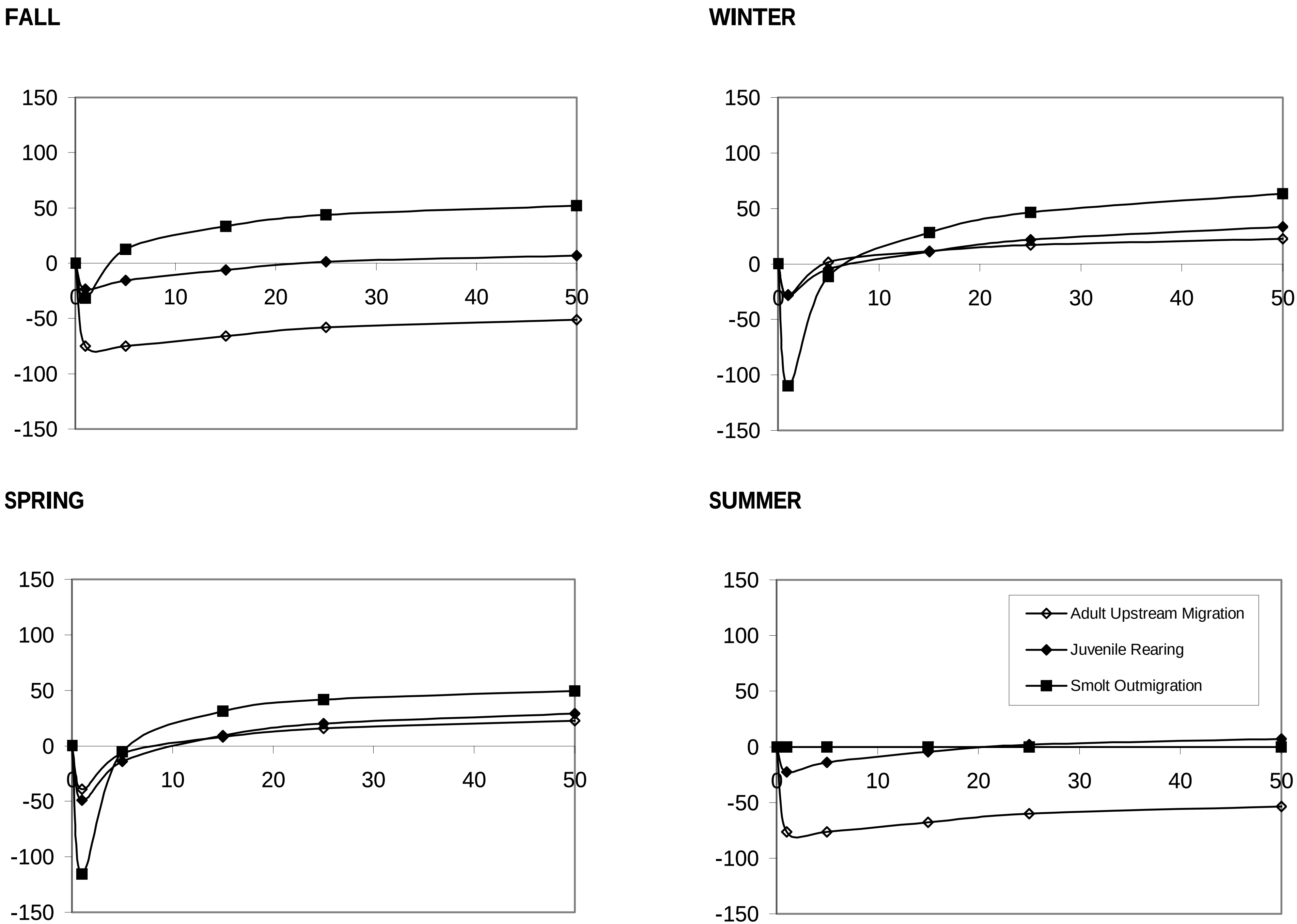
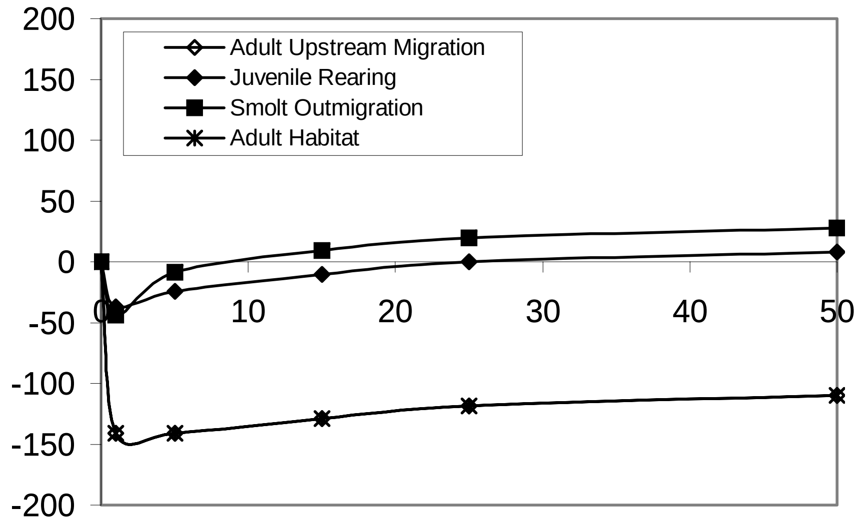
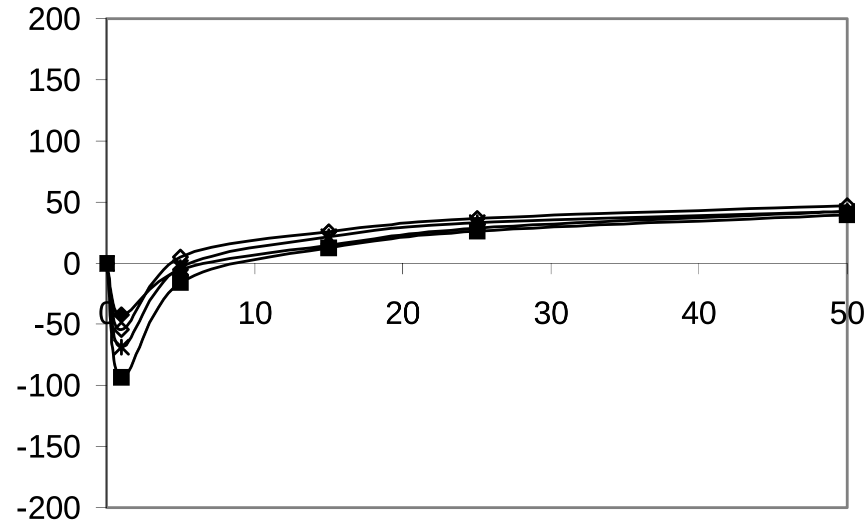


Figure I-4. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site RM 19.0R.

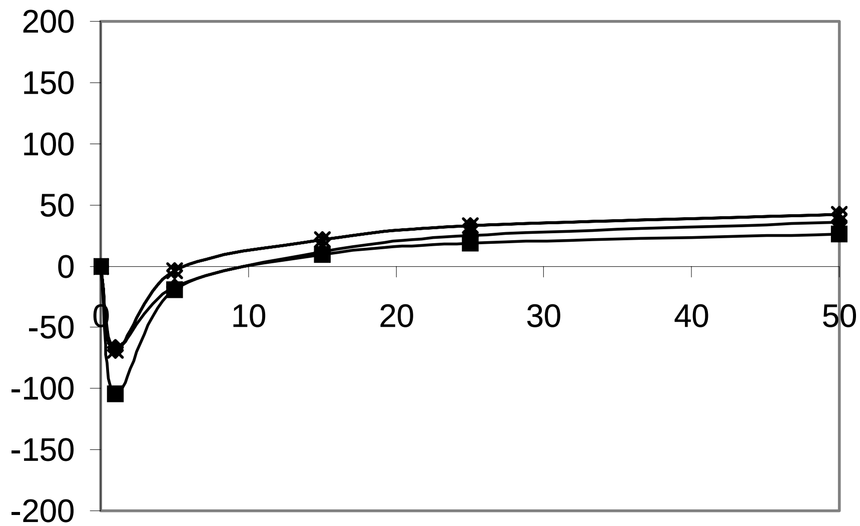
FALL



WINTER



SPRING



SUMMER

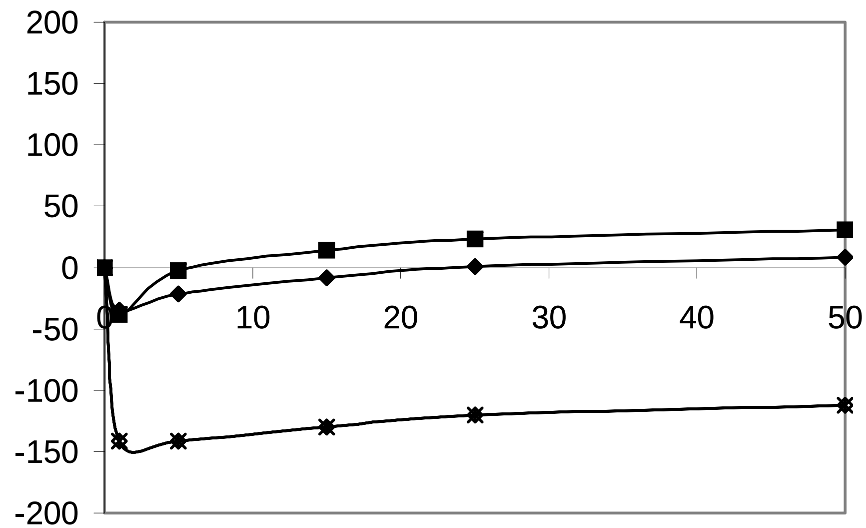


Figure I-5. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site RM 19.0R.

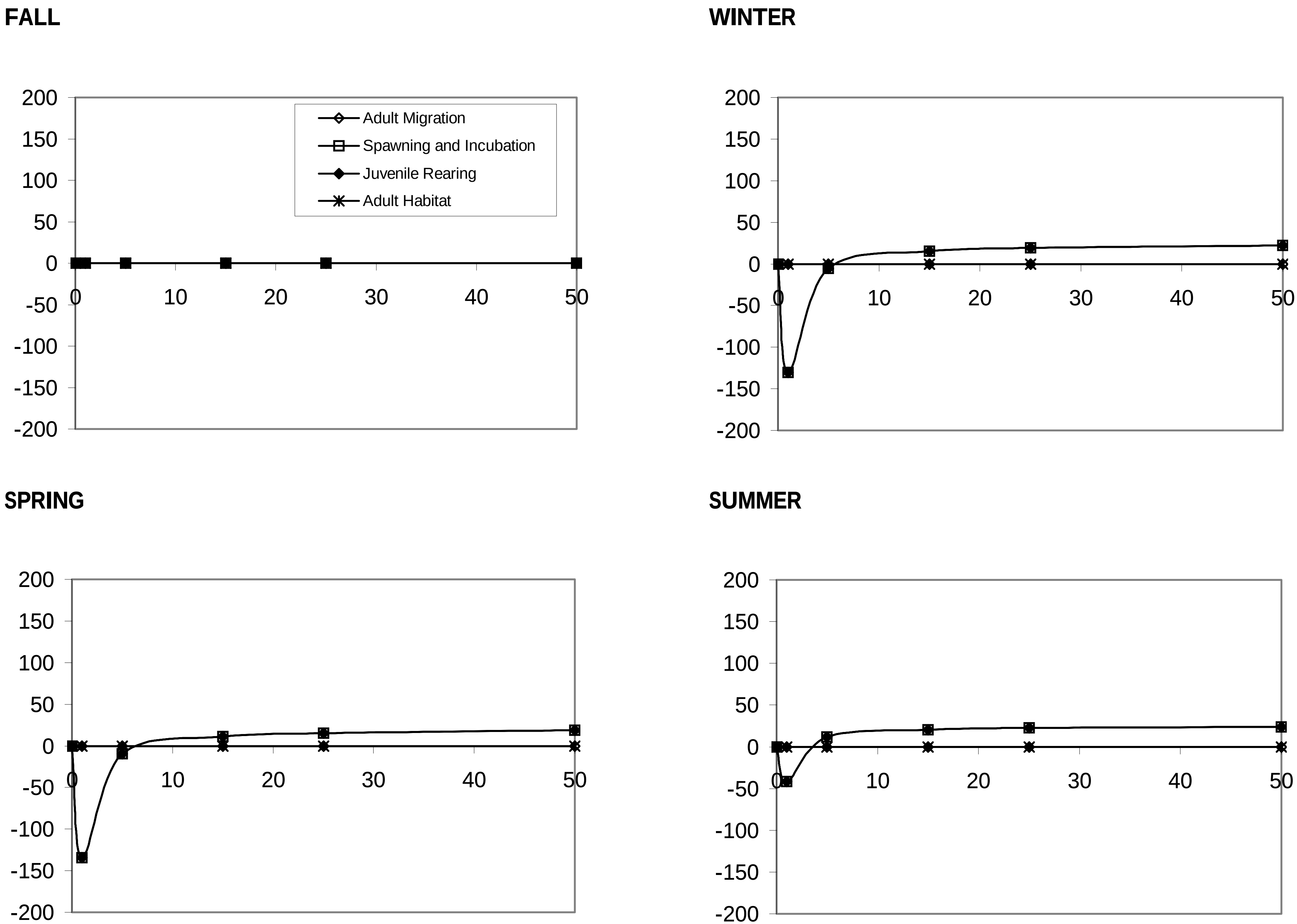


Figure I-6. **SAM results showing bank-line weighted relative response (feet) for Delta smelt at Site RM 19.0R.**

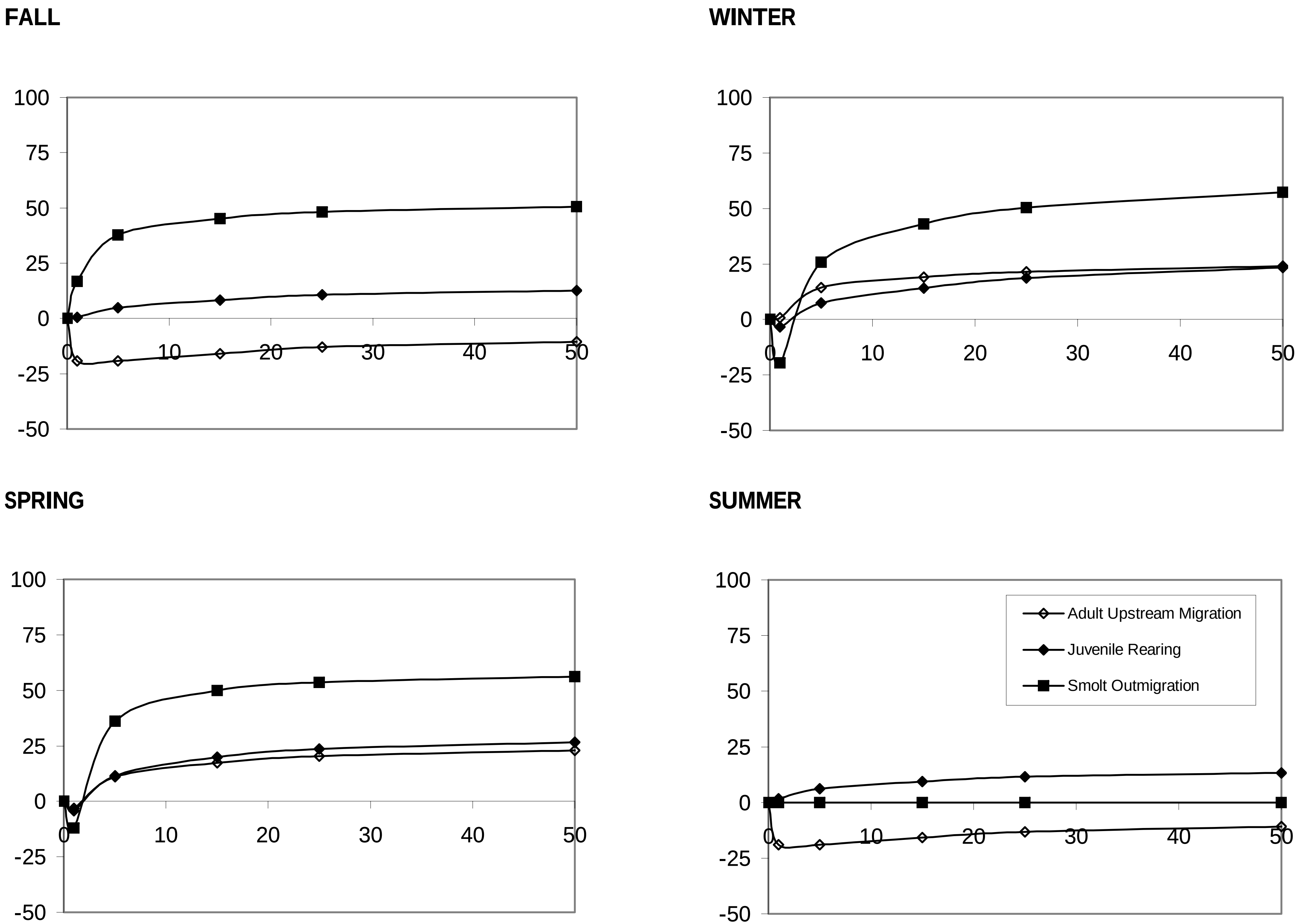


Figure I-7. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site RM 19.4R.

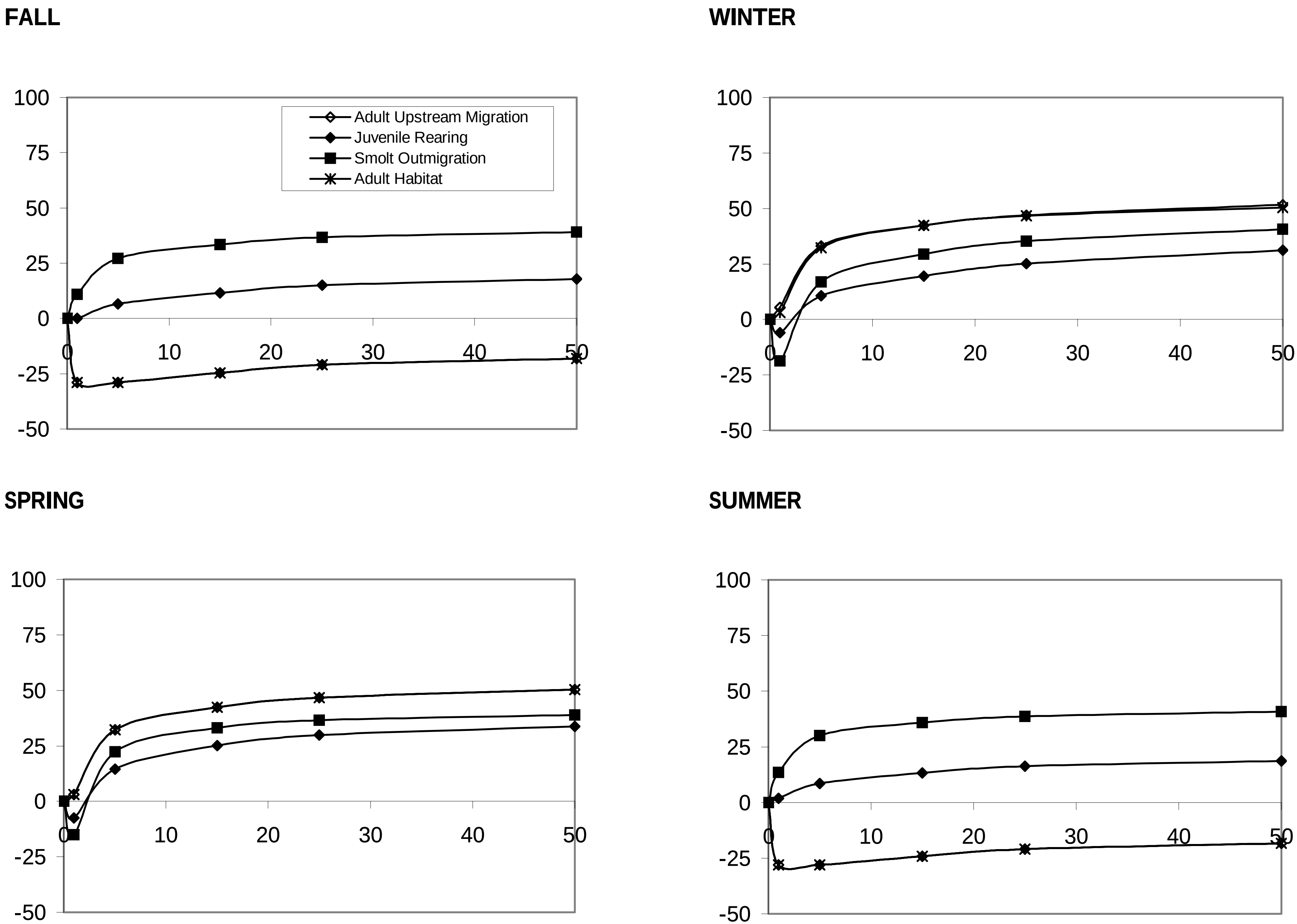


Figure I-8. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site RM 19.4R.

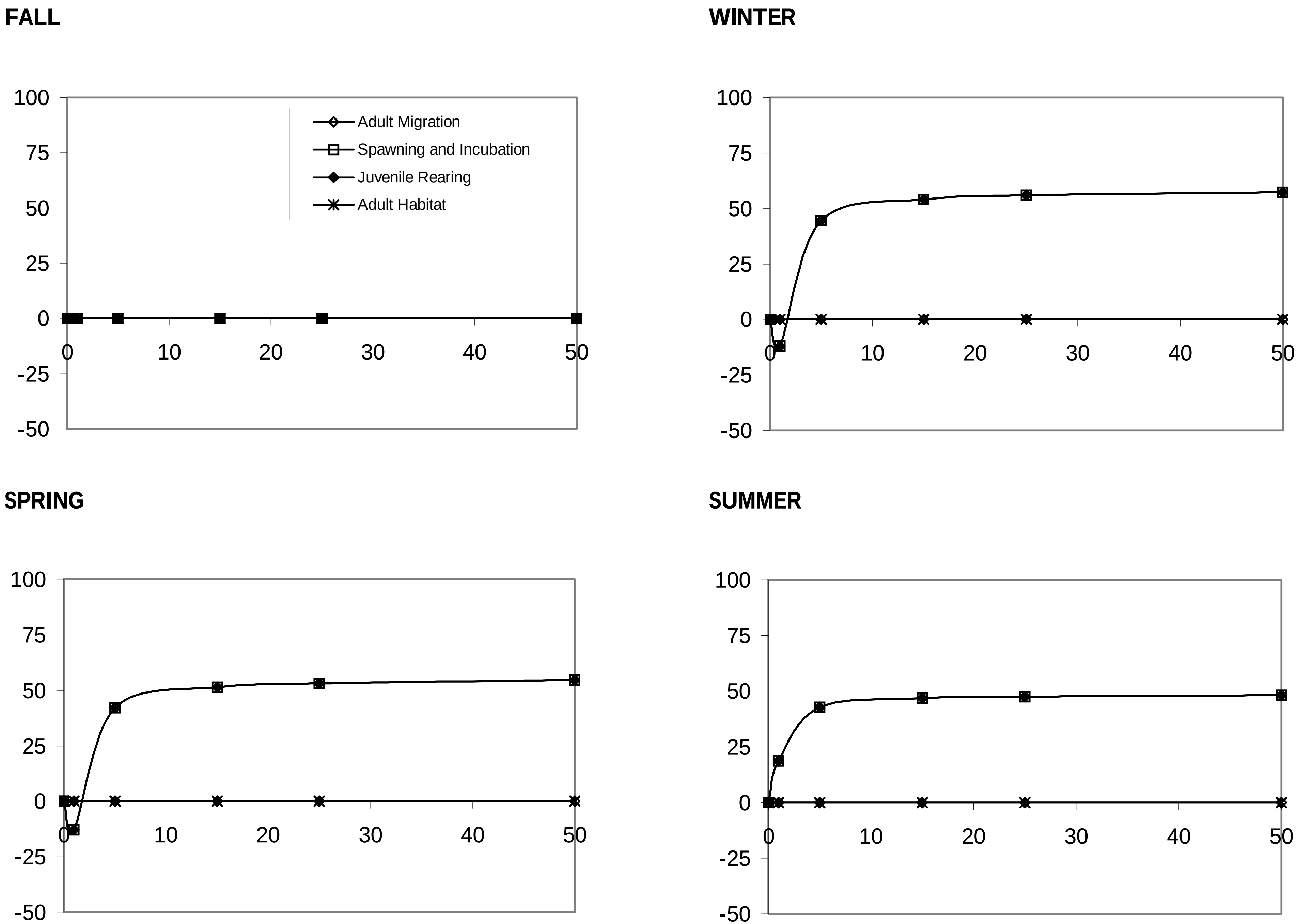


Figure I-9. SAM results showing bank-line weighted relative response (feet) for Delta smelt at Site RM 19.4R.

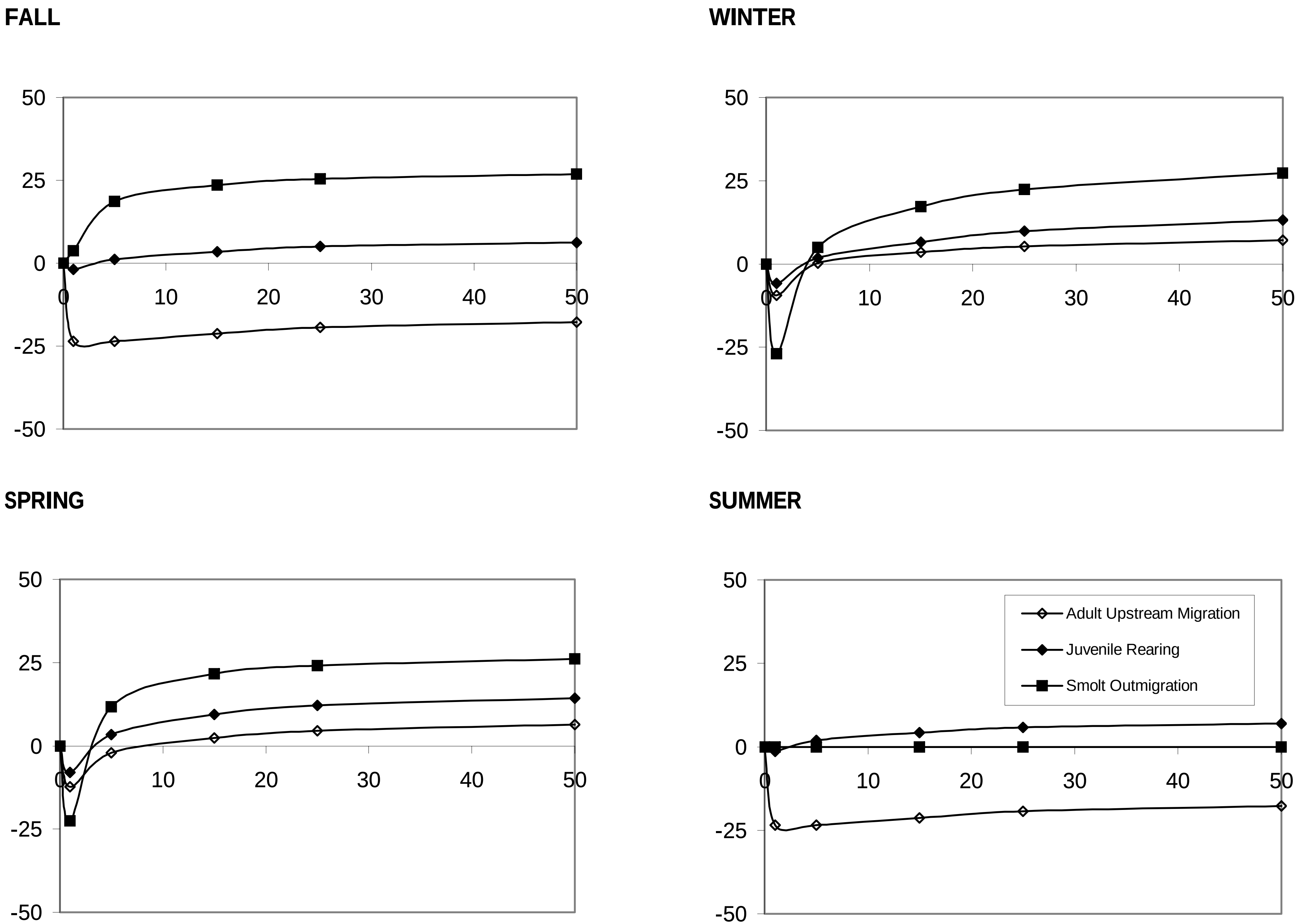


Figure I-10. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site RM 22.7R.

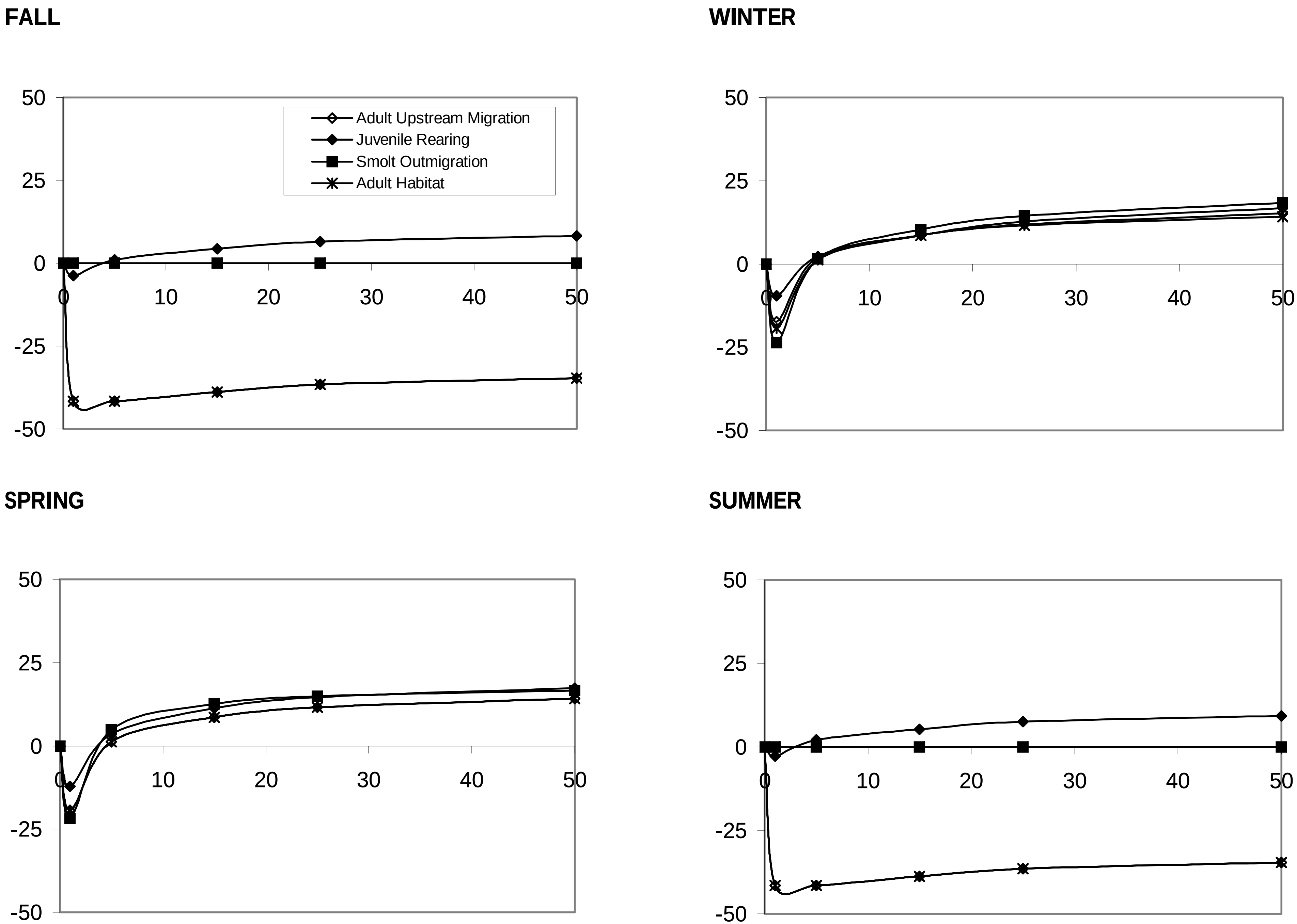


Figure I-11. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site RM 22.7R.

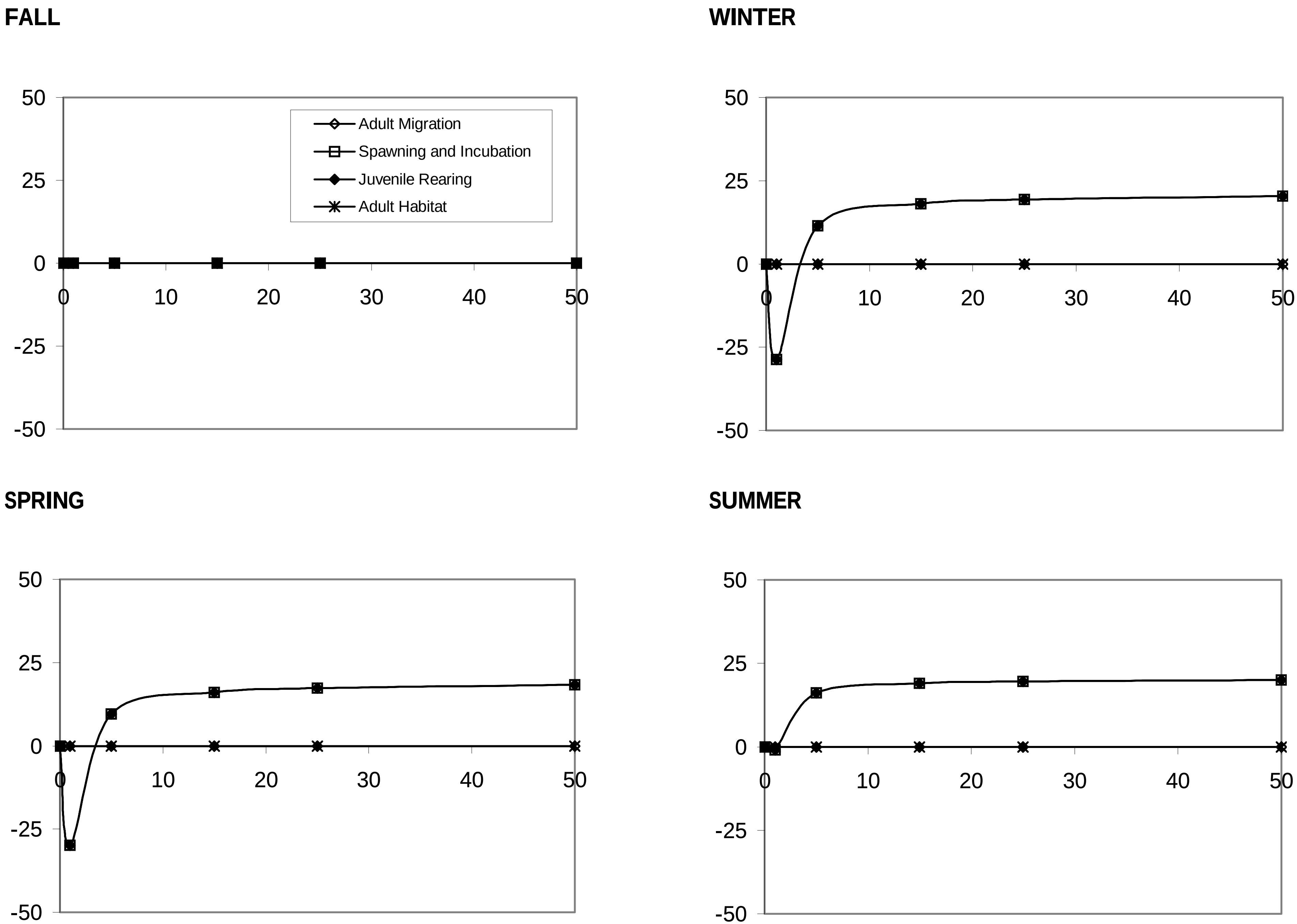


Figure I-12. **SAM results showing bank-line weighted relative response (feet) for Delta smelt at Site 22.7R.**

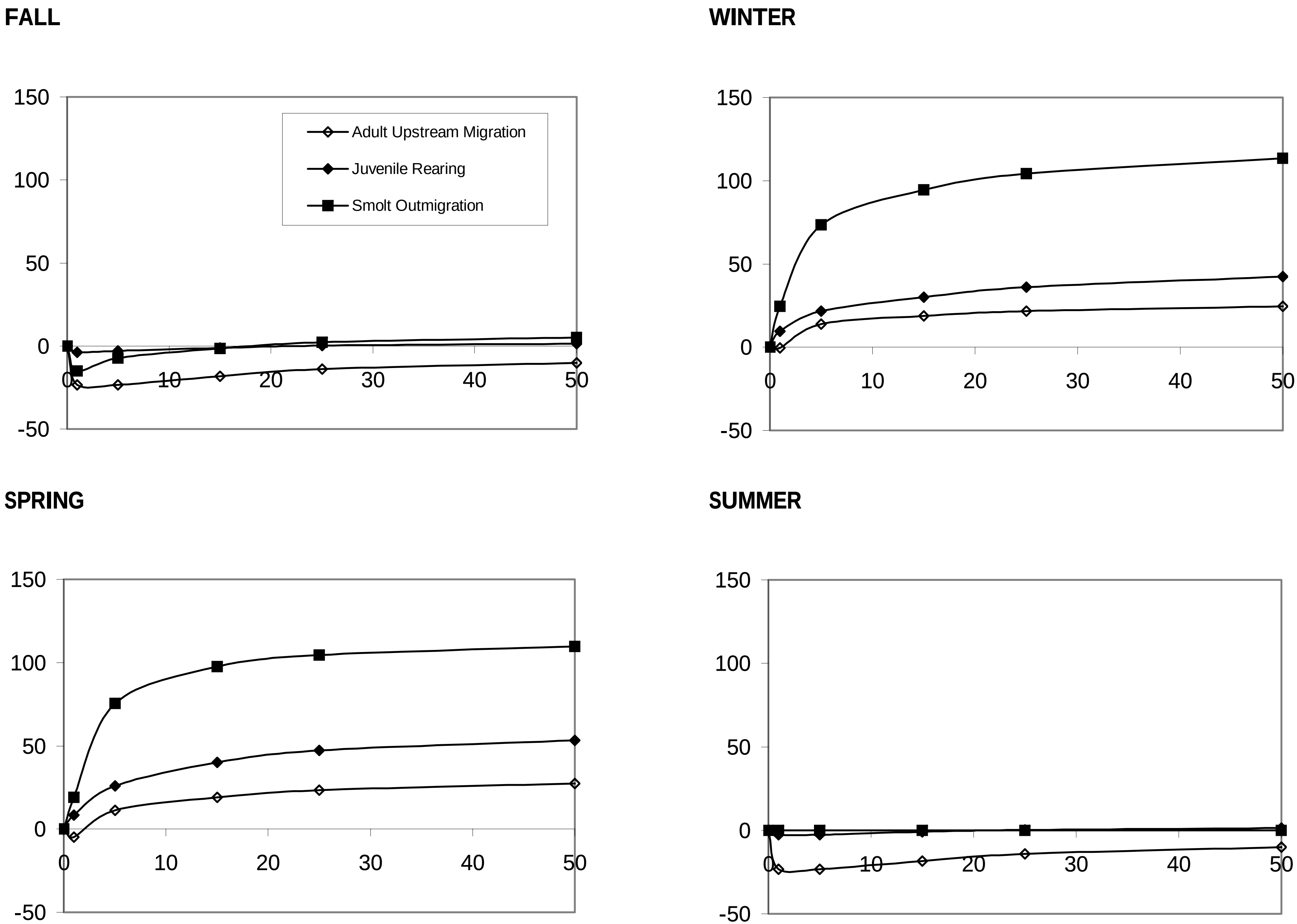


Figure I-13. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site RM 33.0R.

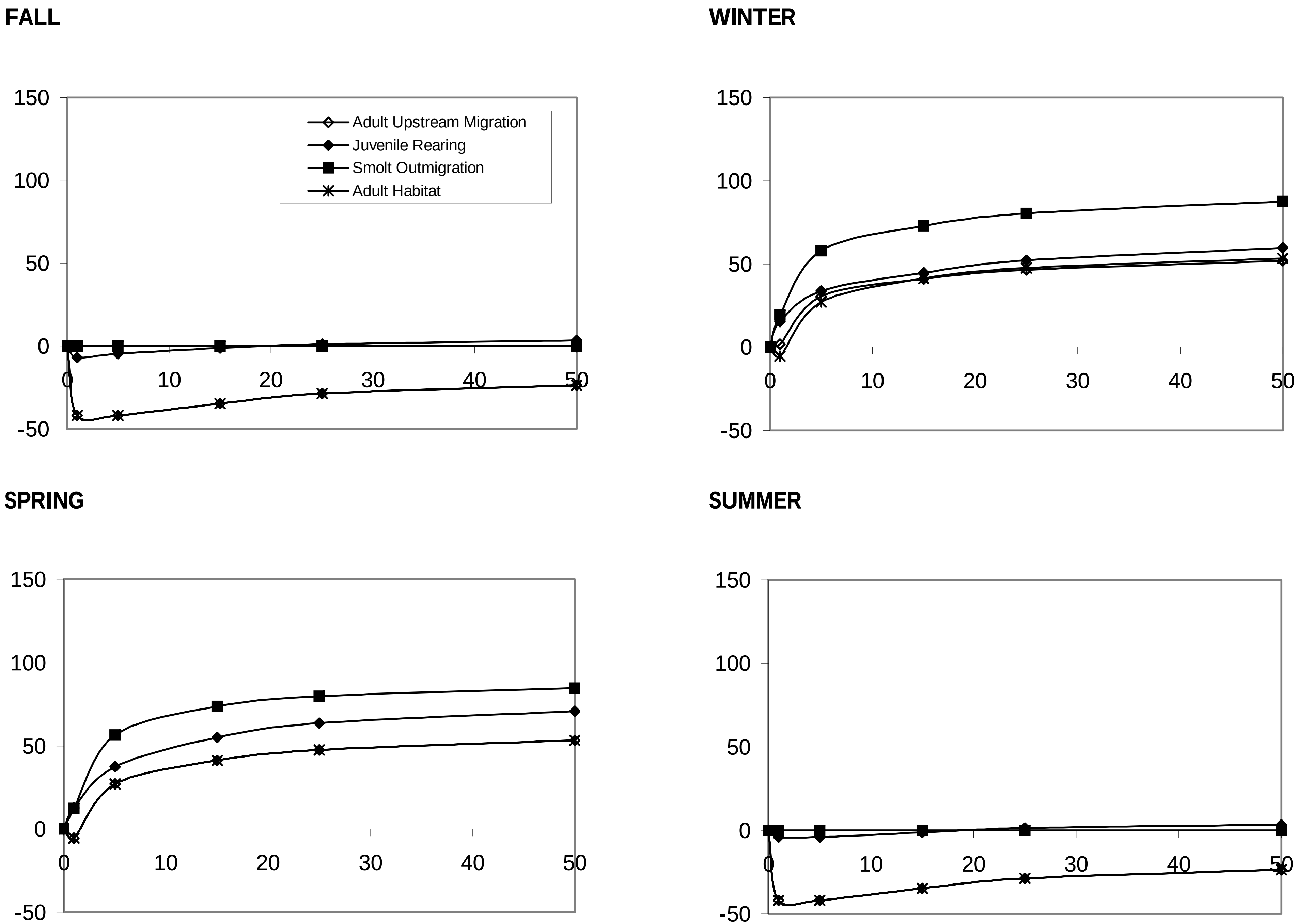


Figure I-14. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site RM 33.0R.

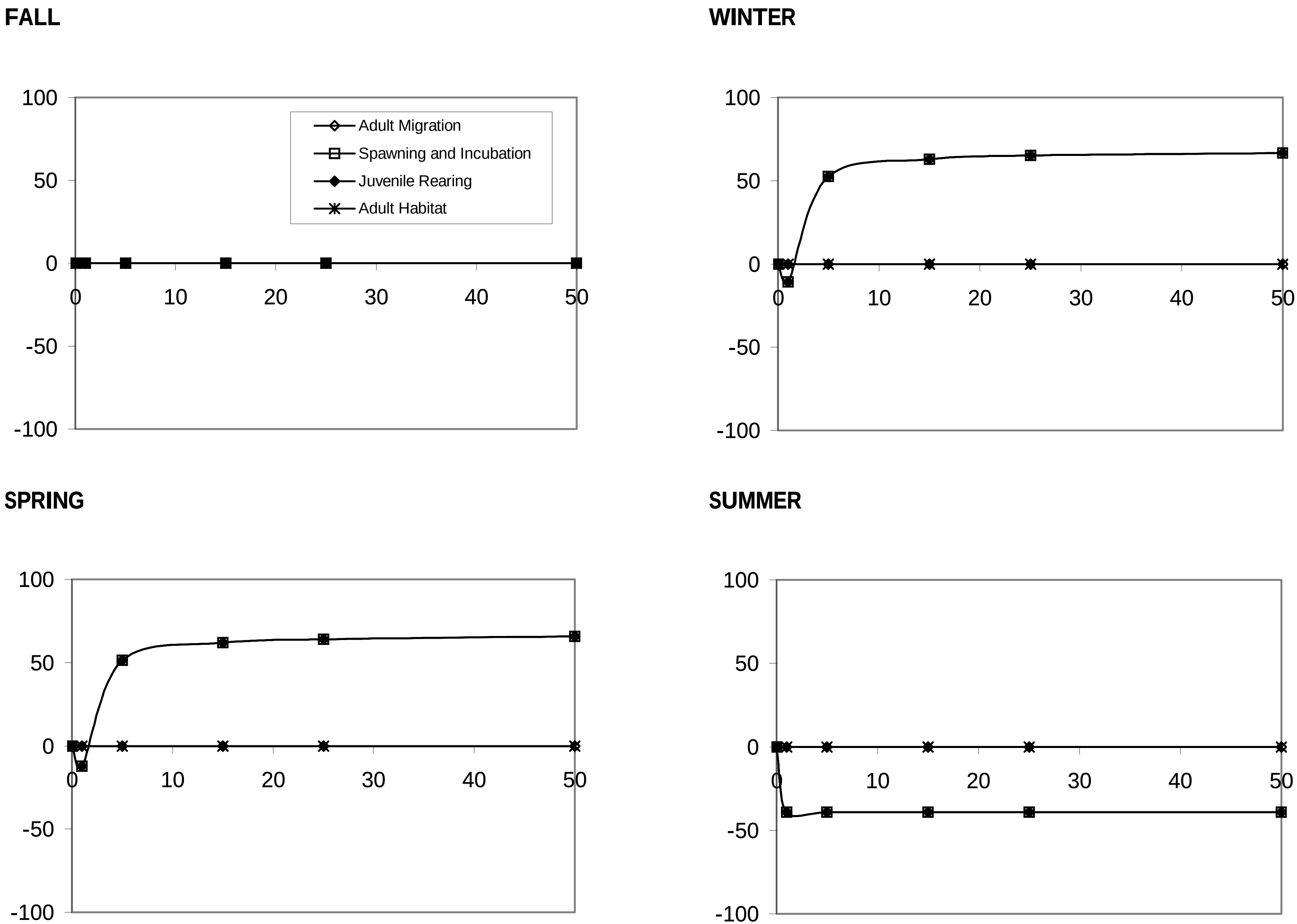


Figure I-15. SAM results showing bank-line weighted relative response (feet) for Delta smelt at Site RM 33.0R.

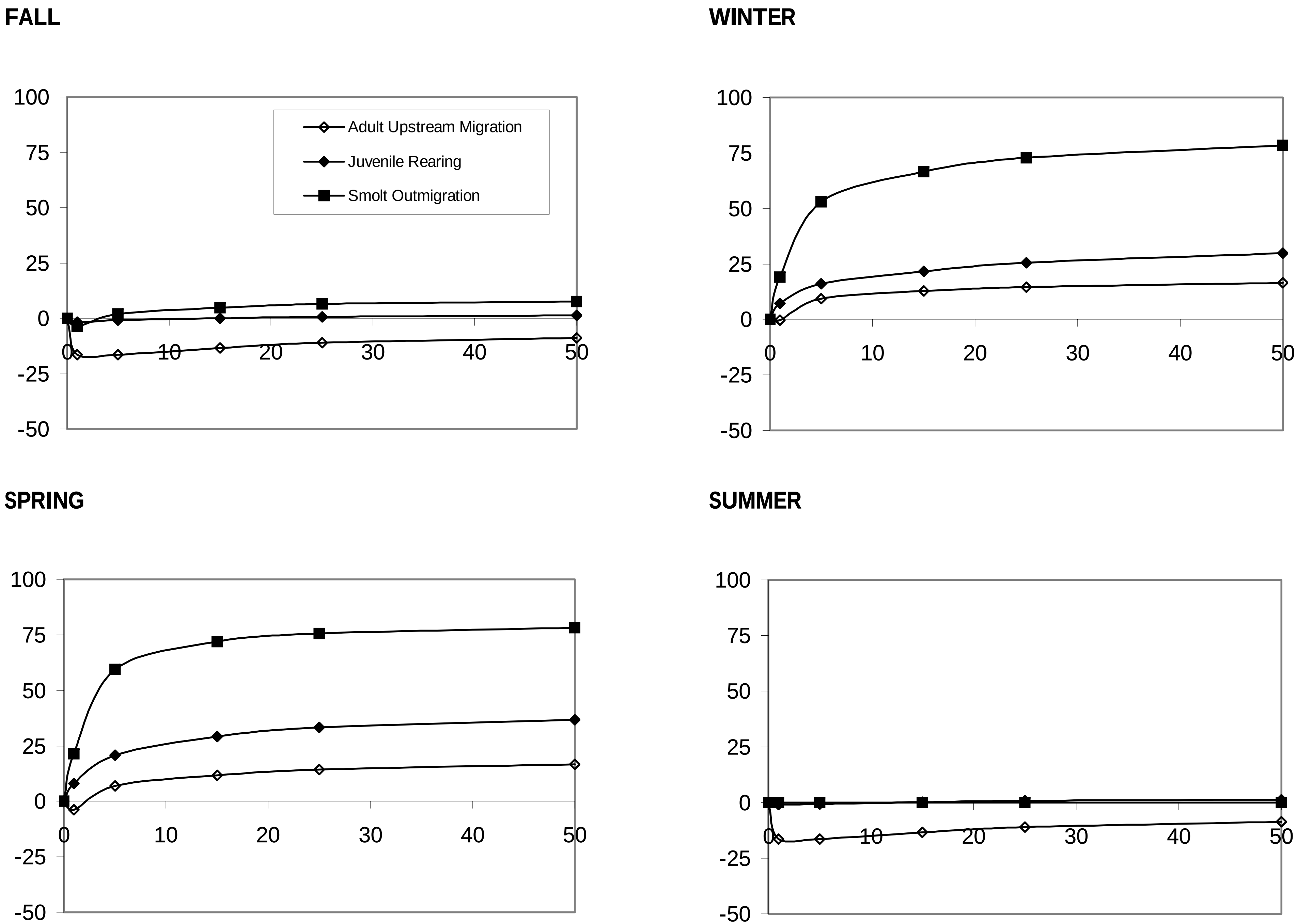


Figure I-16. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site RM 33.3R.

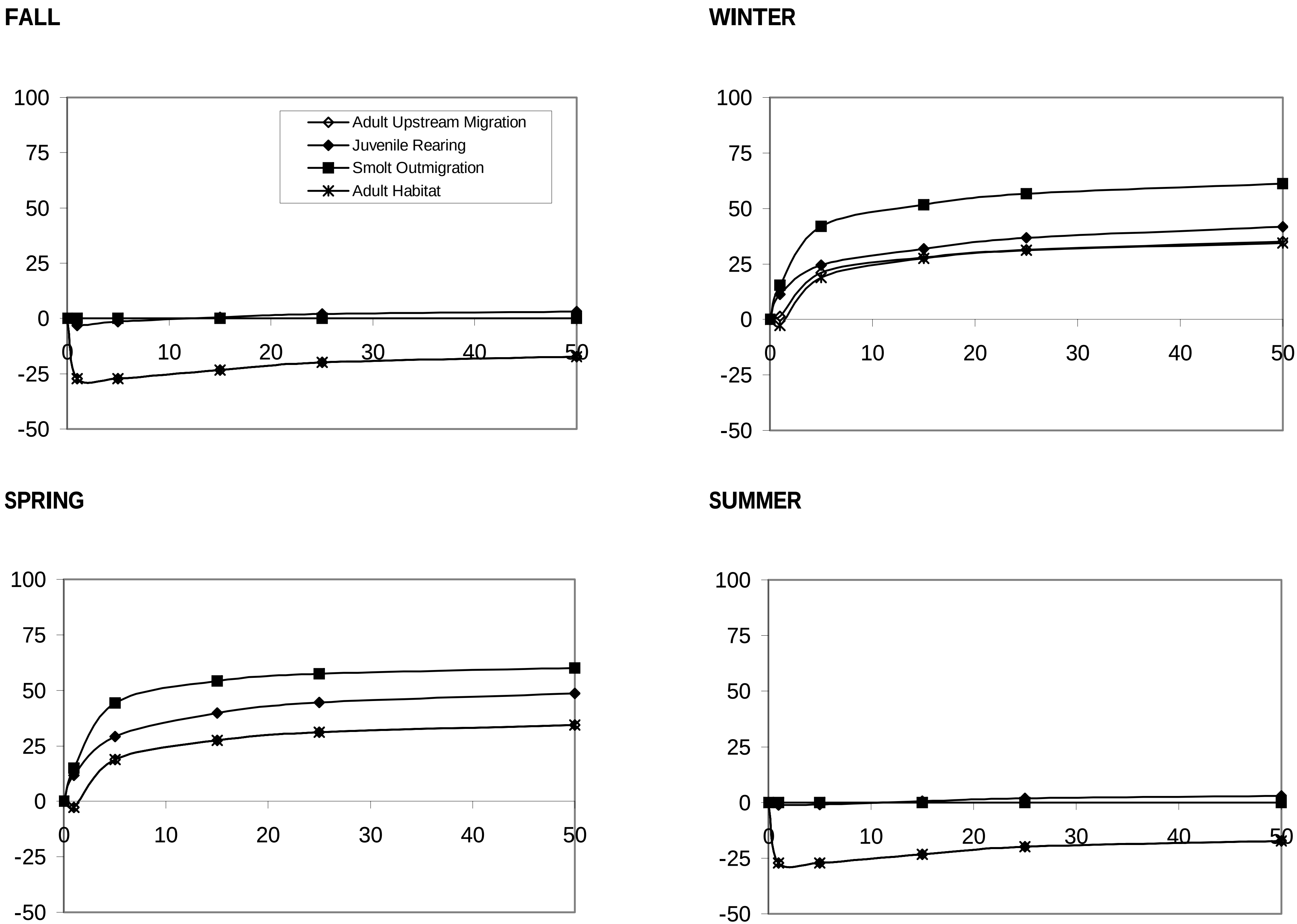


Figure I-17. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site RM 33.3R.

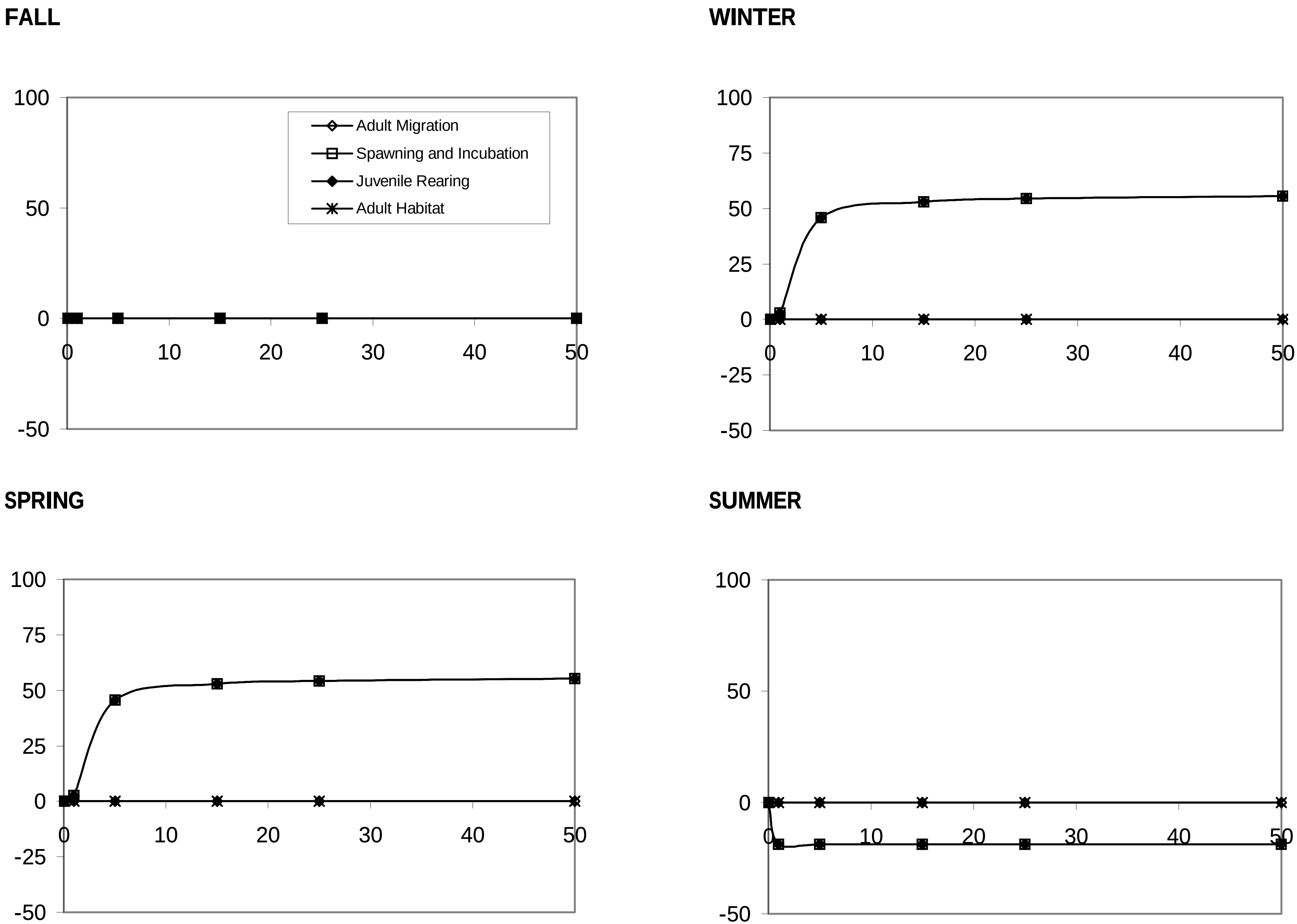


Figure I-18. SAM results showing bank-line weighted relative response (feet) for Delta smelt at Site RM 33.3R.

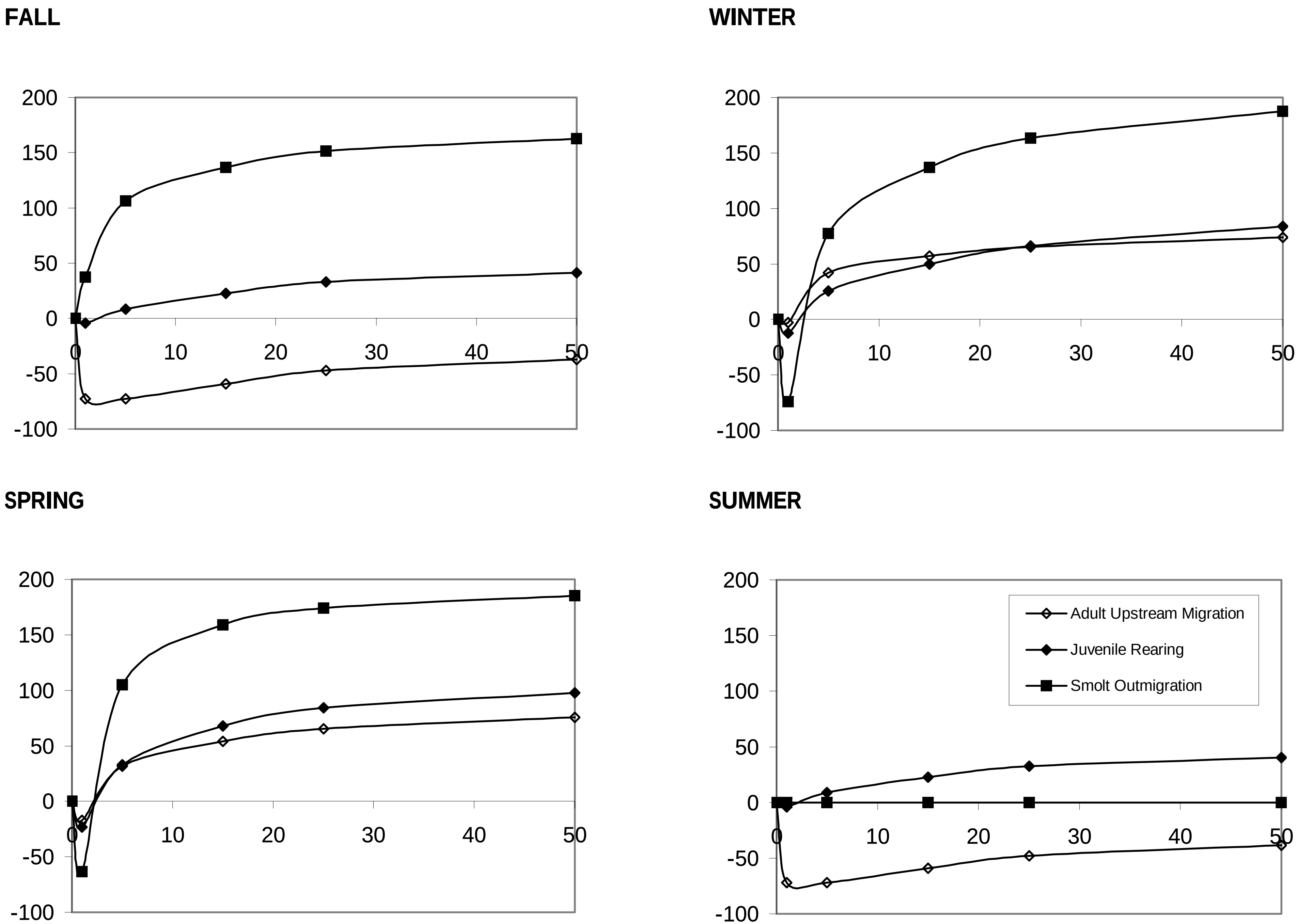


Figure I-19. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site RM 43.7R.

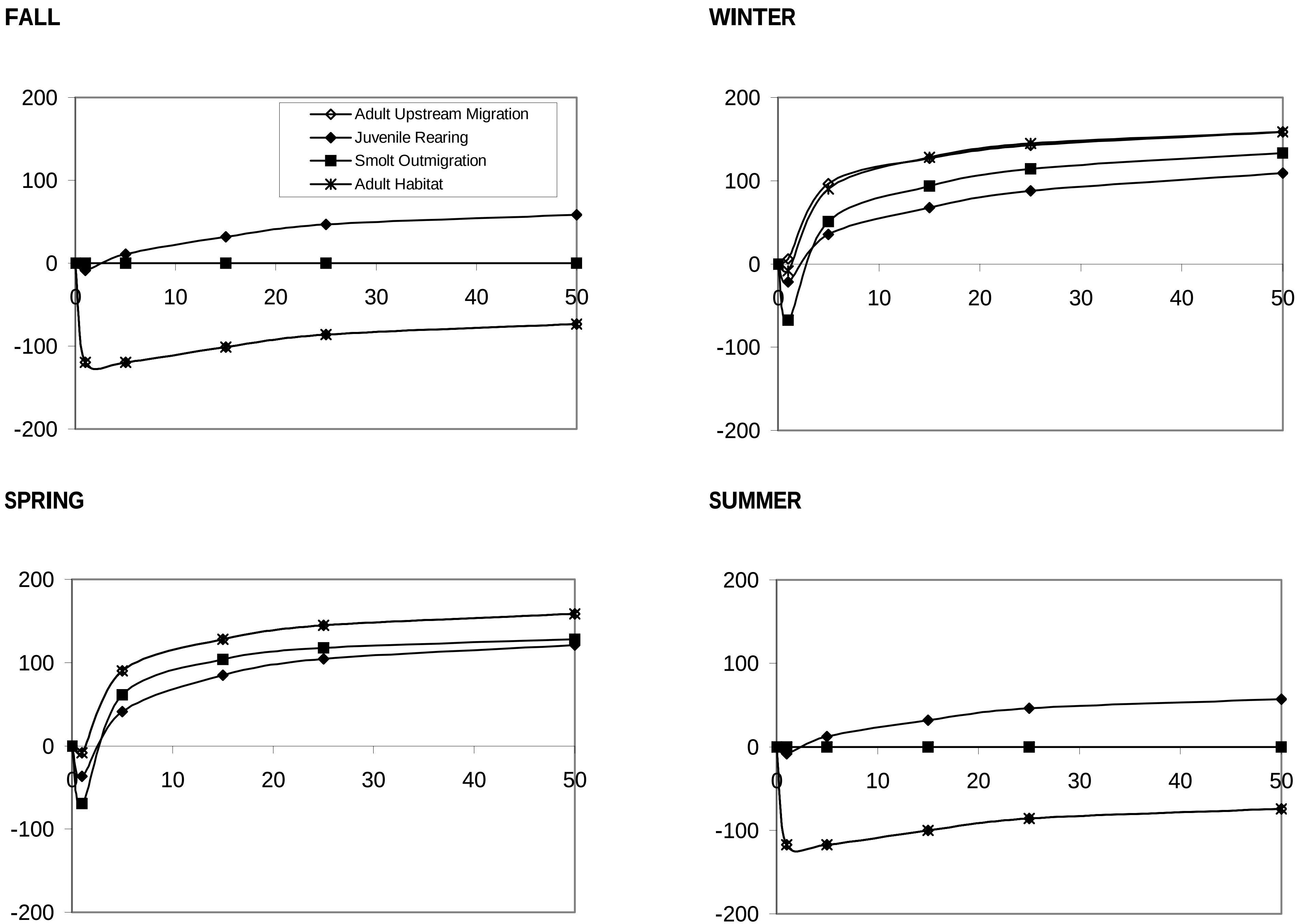


Figure I-20. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site RM 43.7R.

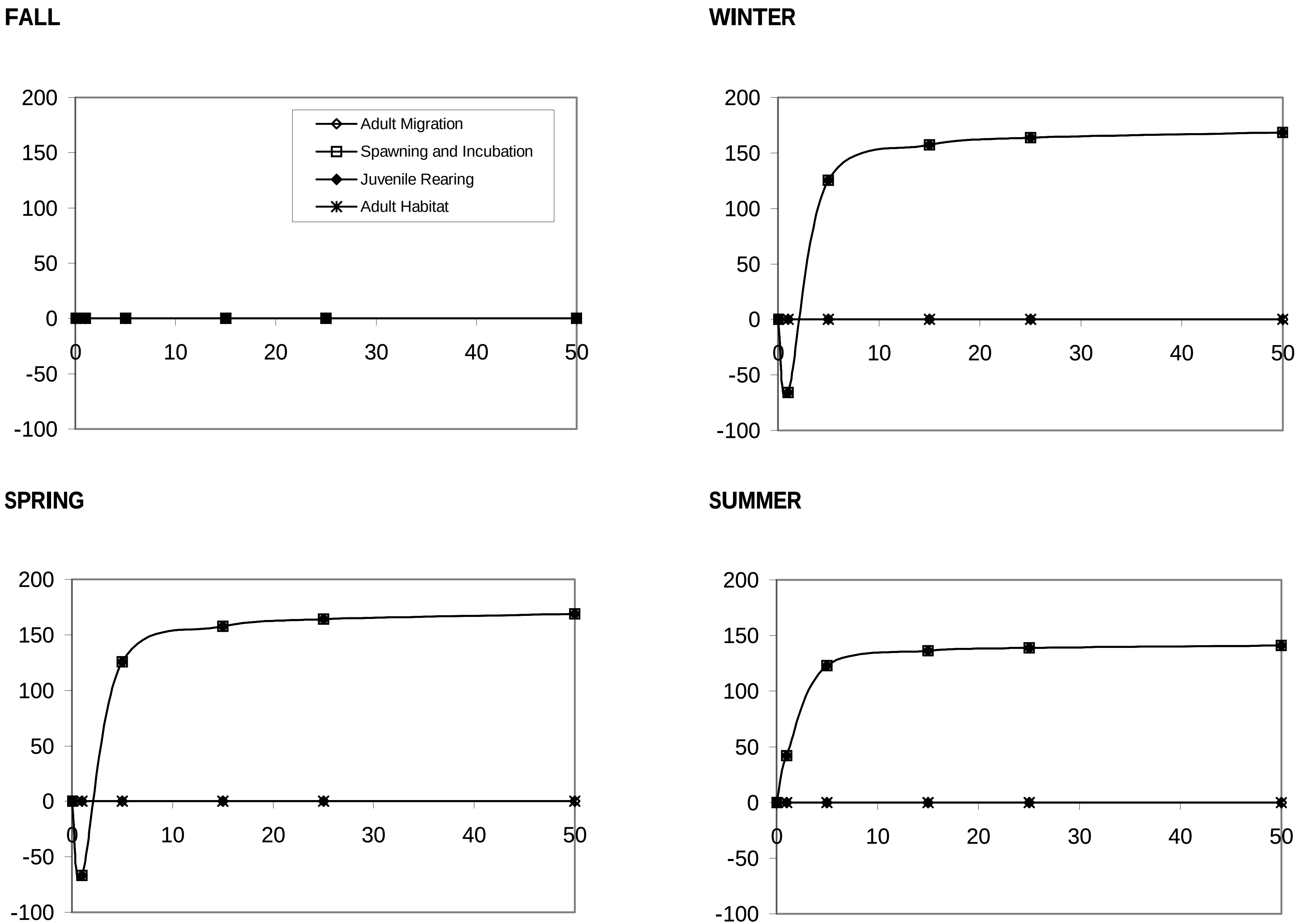


Figure I-21. SAM results showing bank-line weighted relative response (feet) for Delta smelt at Site RM 43.7R.

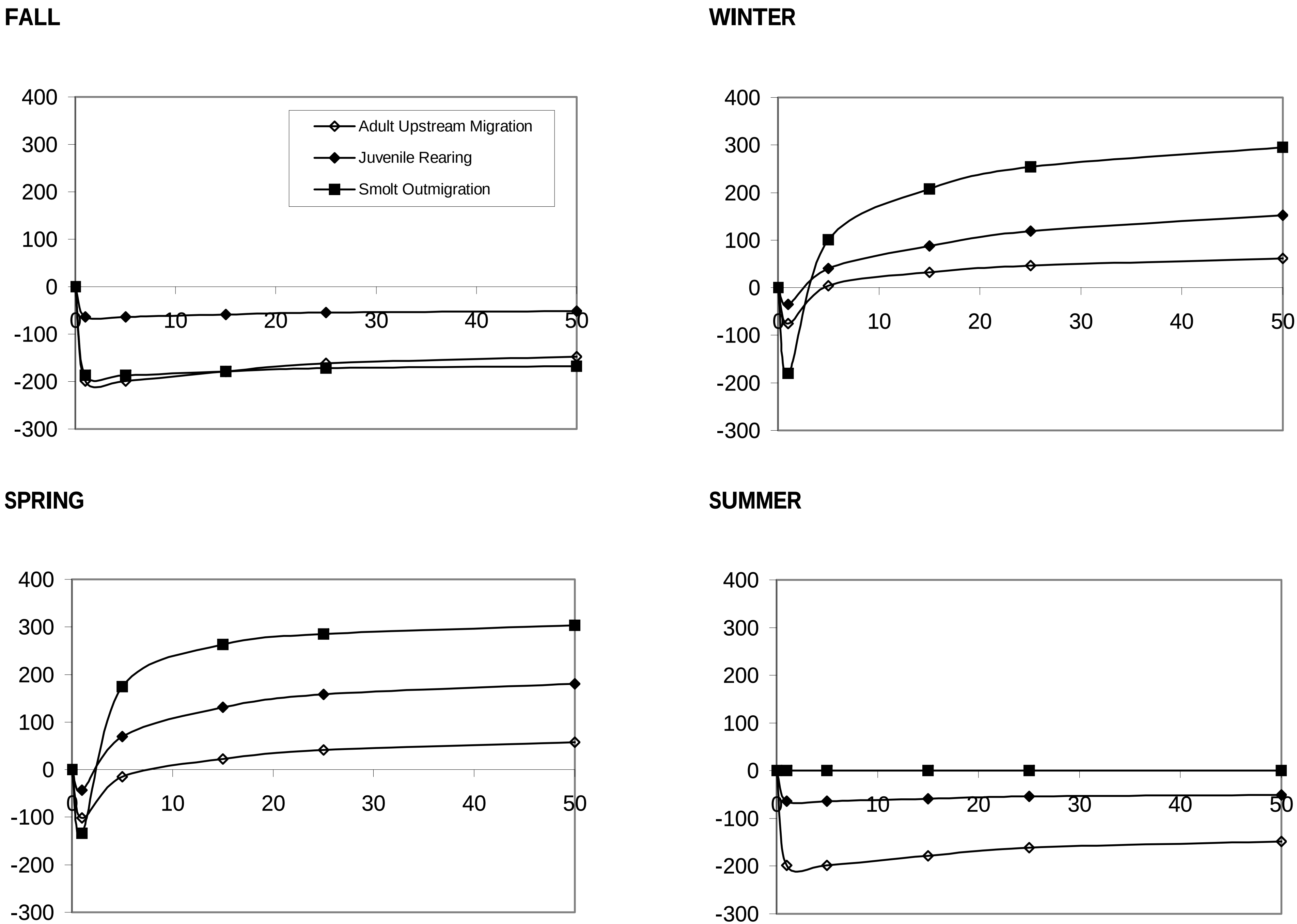


Figure I-22. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site RM 44.7R.

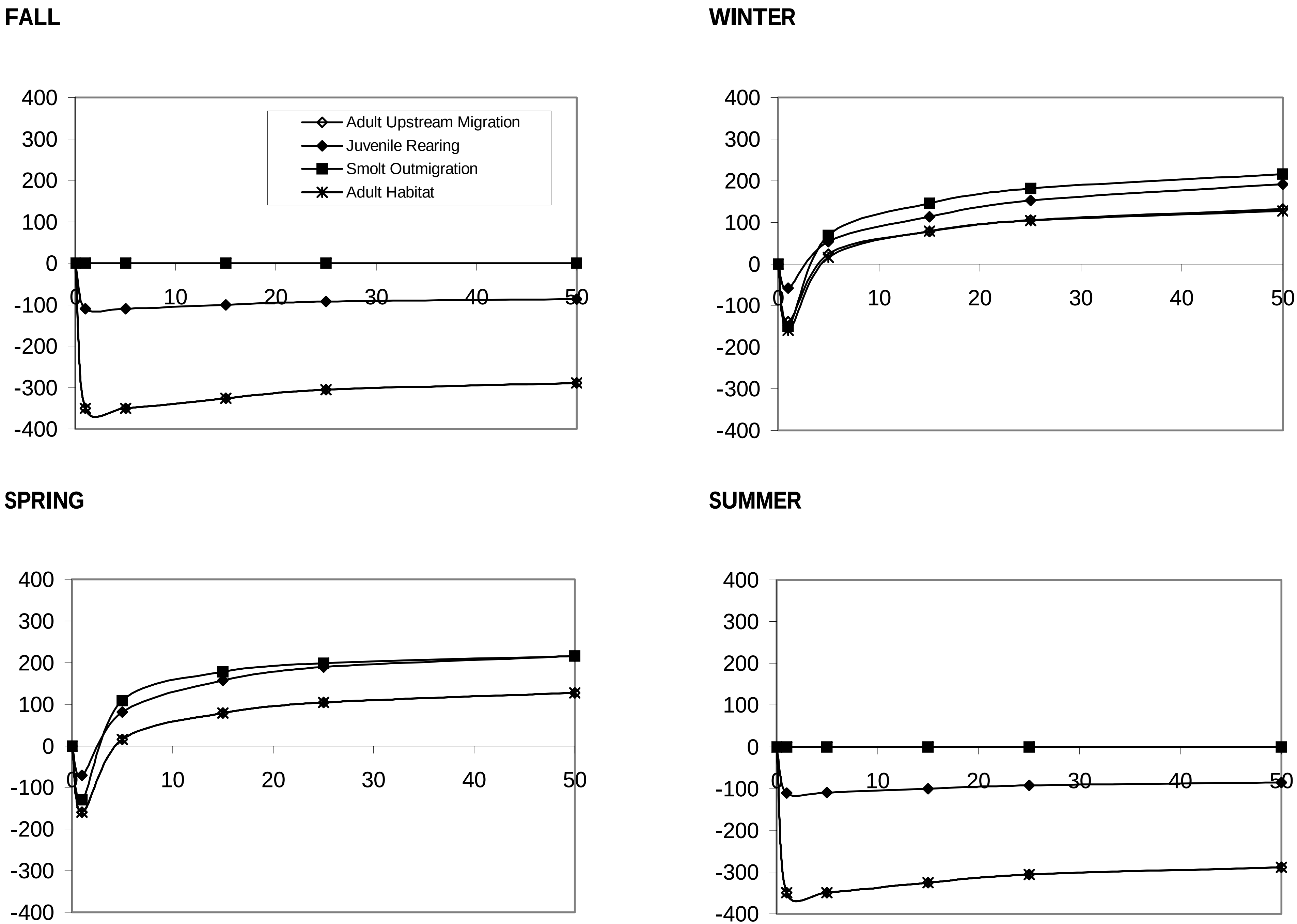


Figure I-23. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site RM 44.7R.

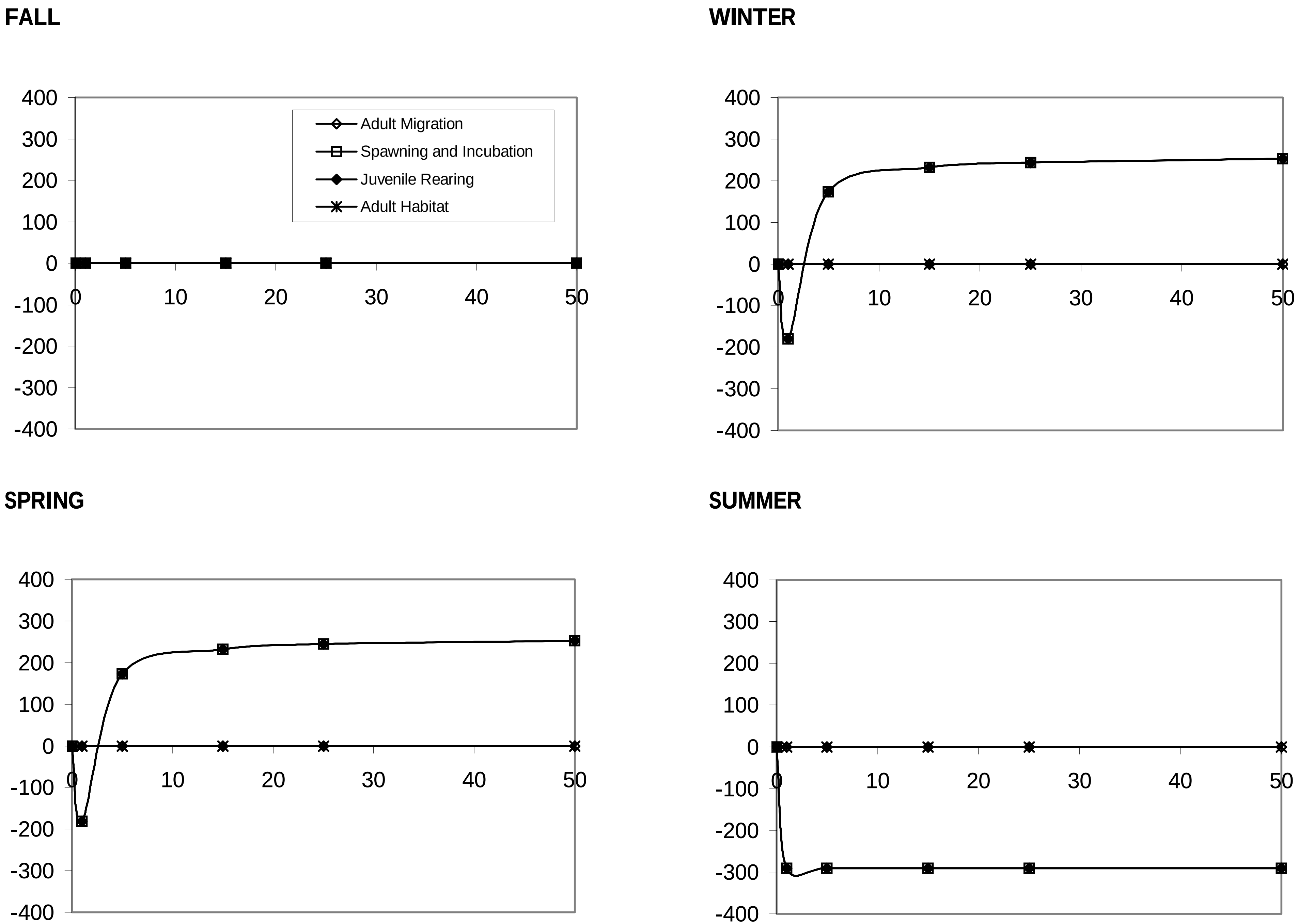


Figure I-24. SAM results showing bank-line weighted relative response (feet) for Delta smelt at Site RM 44.7R.

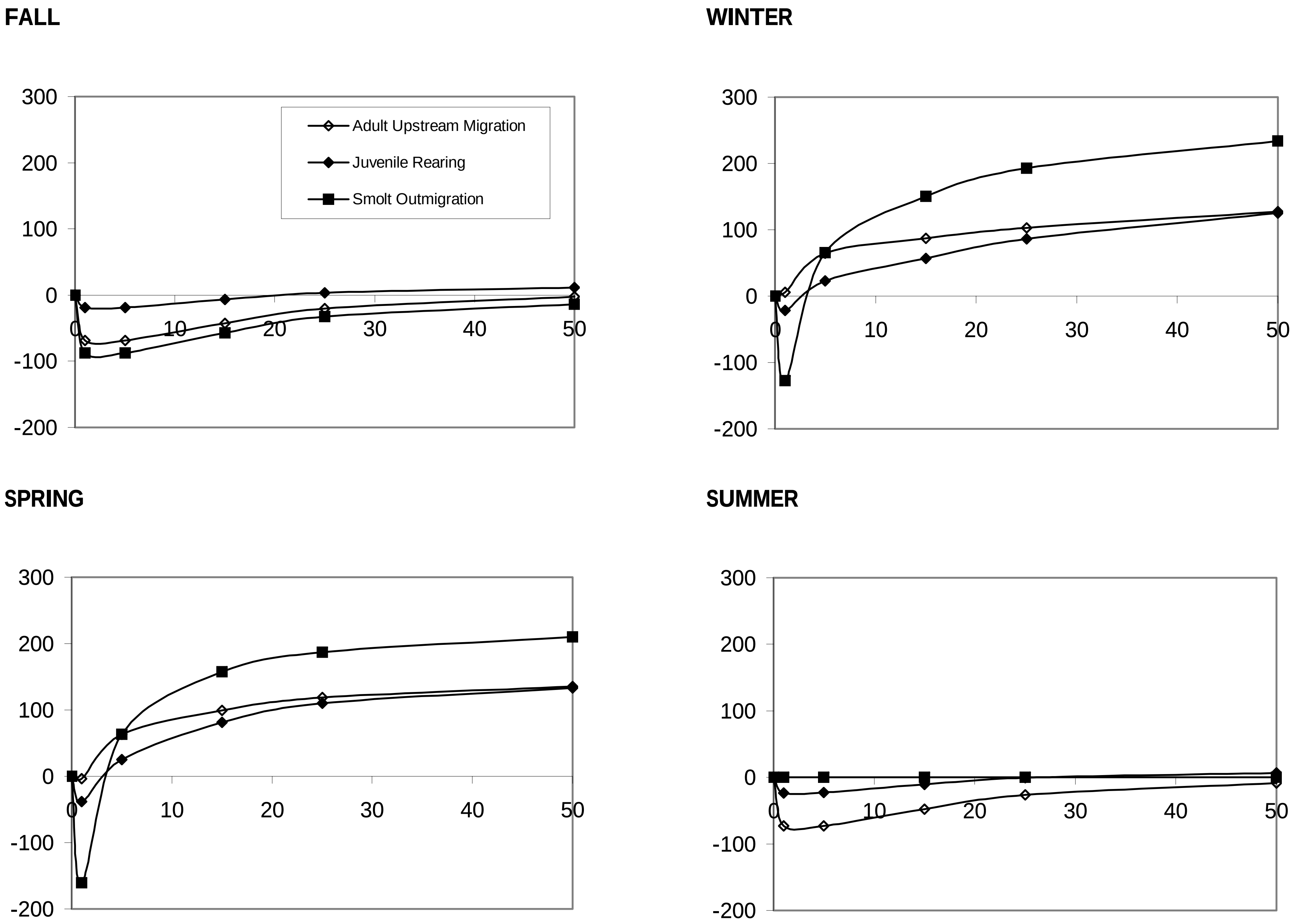


Figure I-25. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site RM 47.0L.

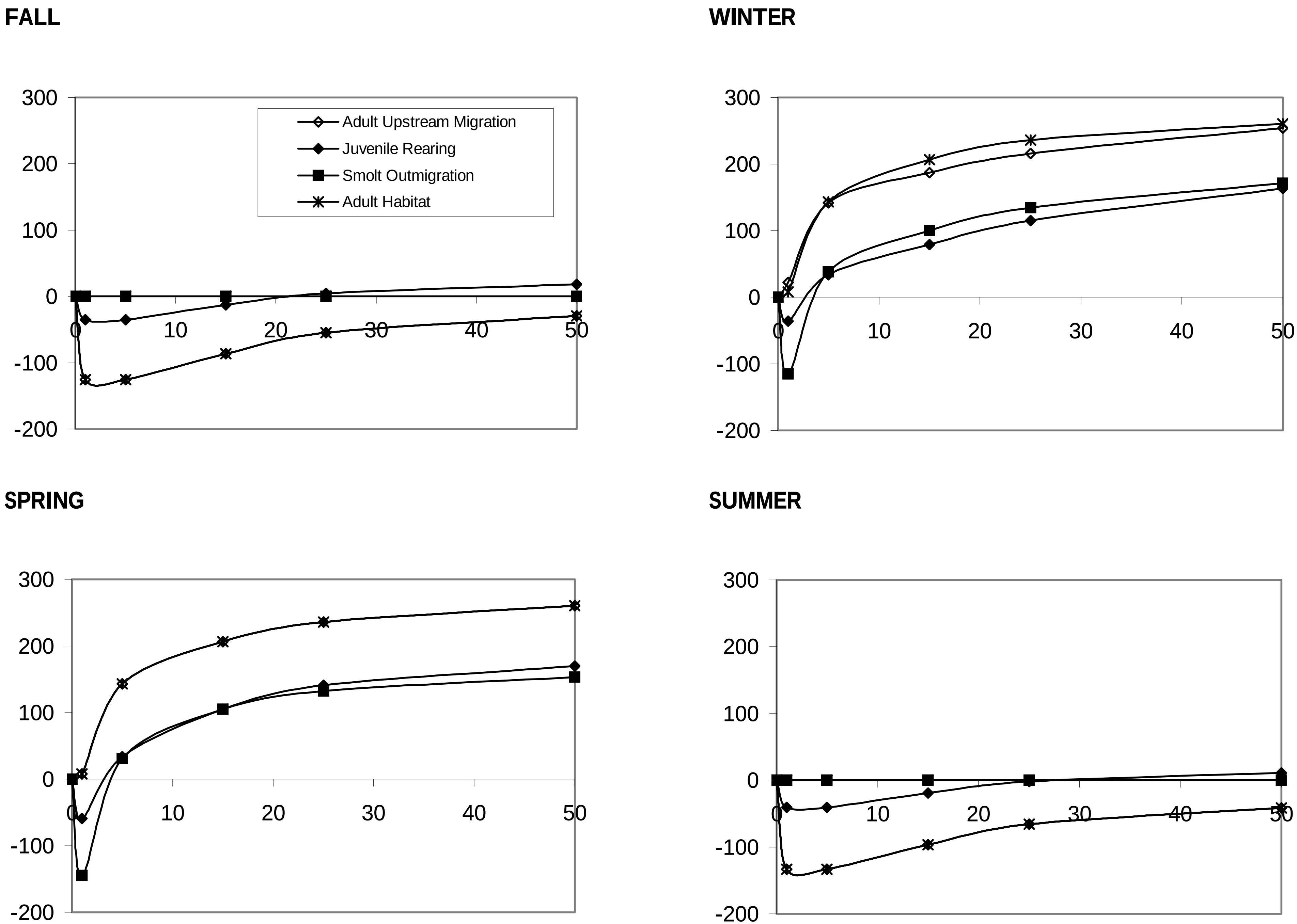


Figure I-26. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site RM 47.0L.

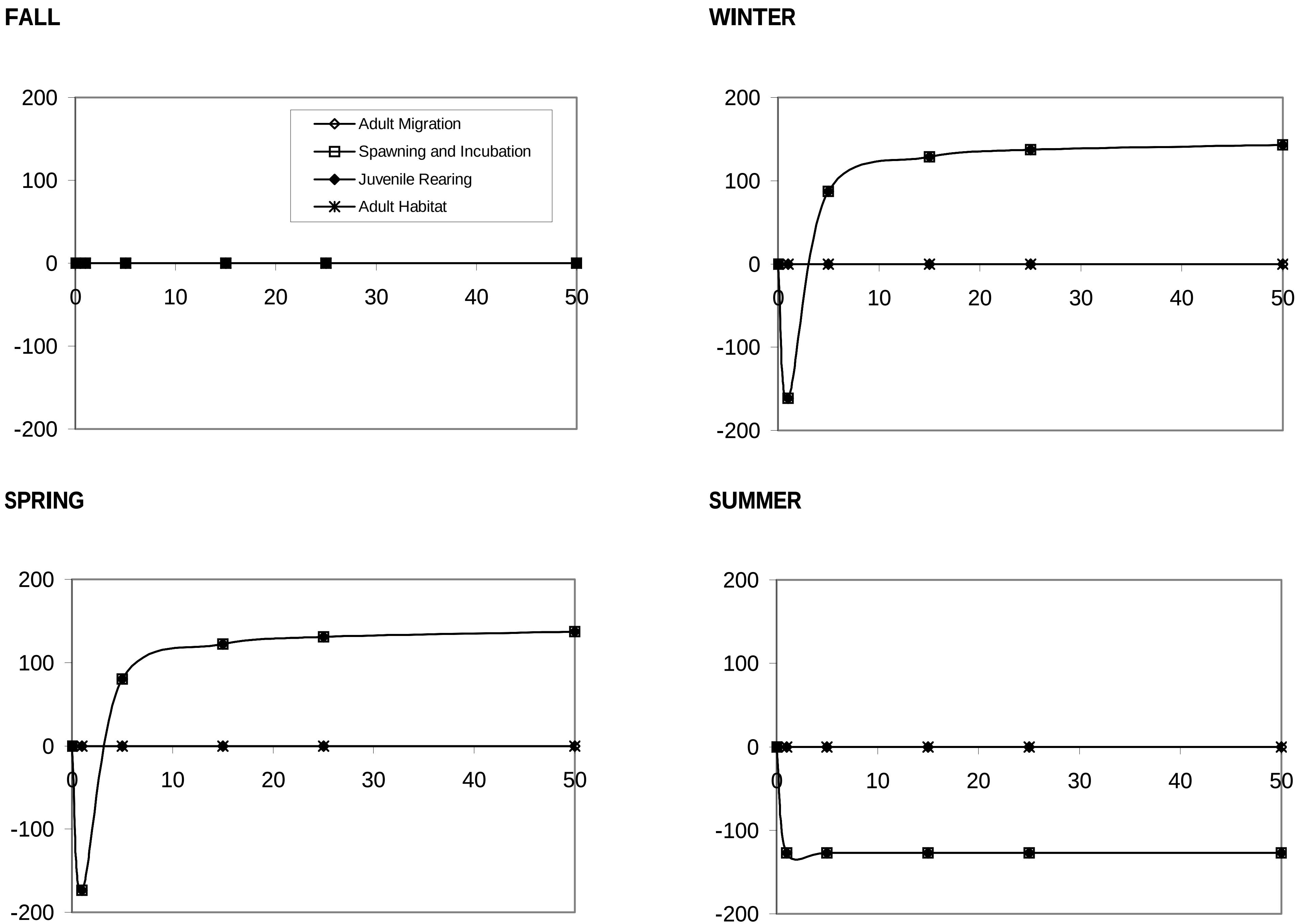


Figure I-27. SAM results showing bank-line weighted relative response (feet) for Delta smelt at Site RM 47.0L.

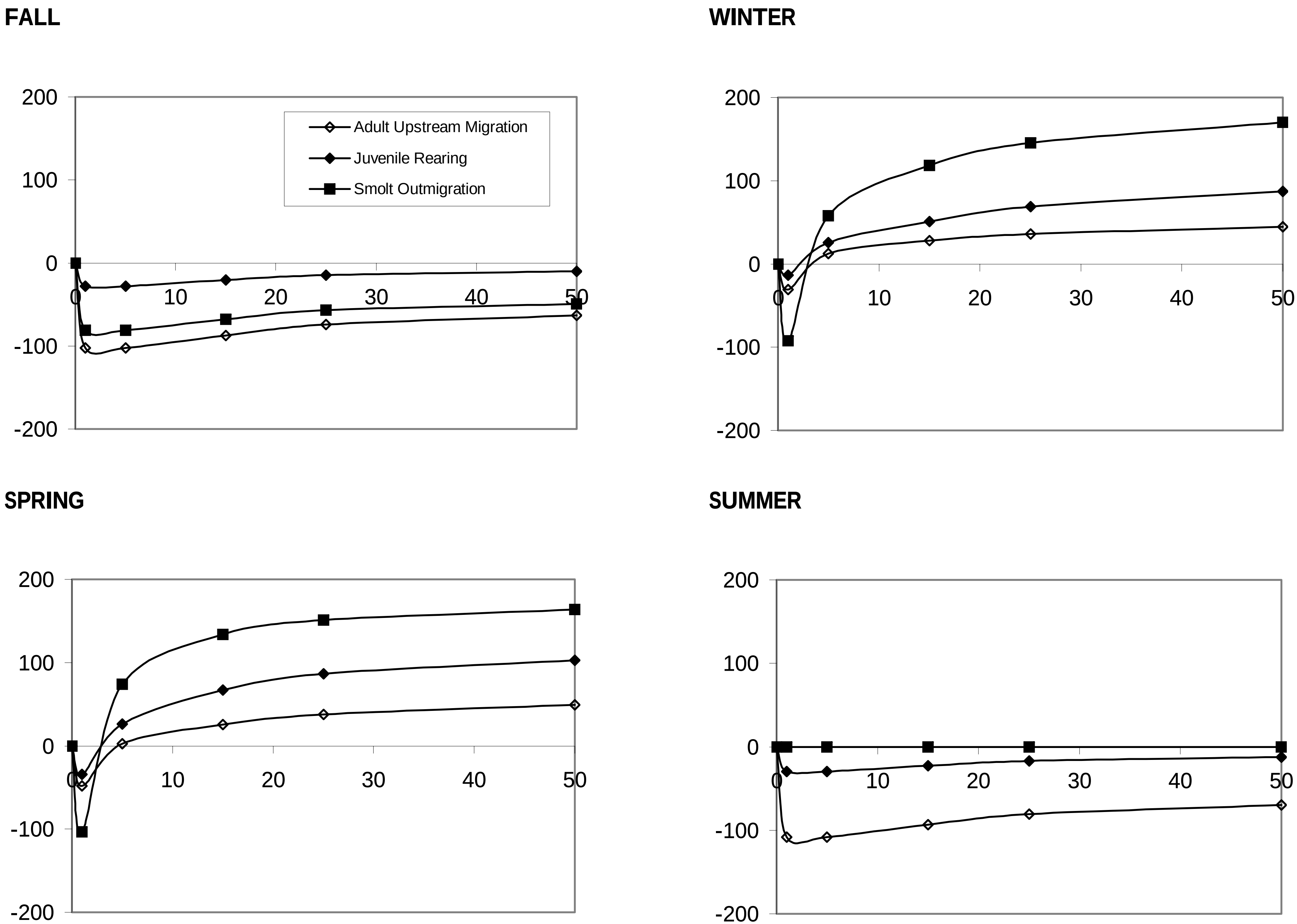


Figure I-28. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site RM 47.9R.

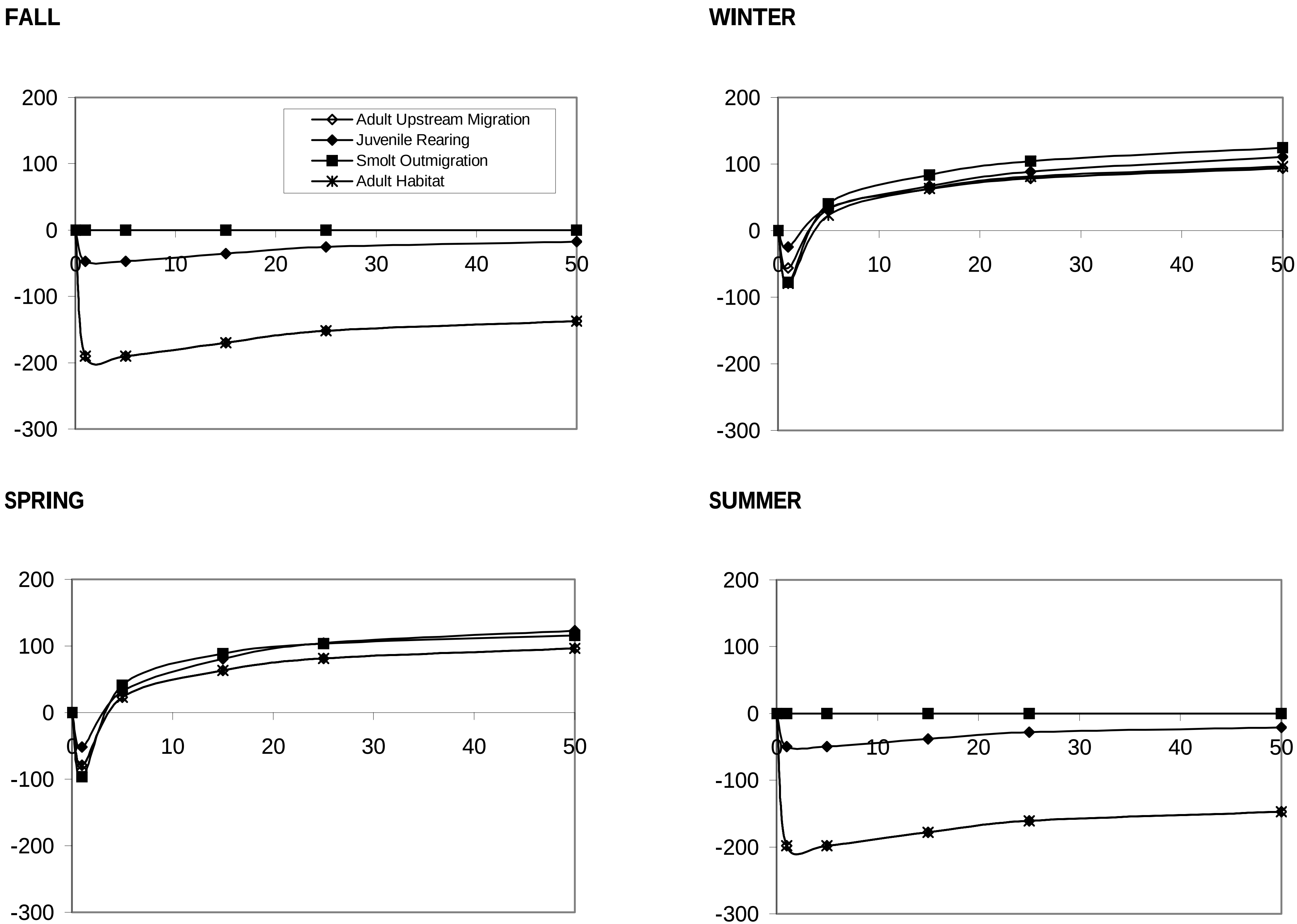


Figure I-29. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site RM 47.9R.

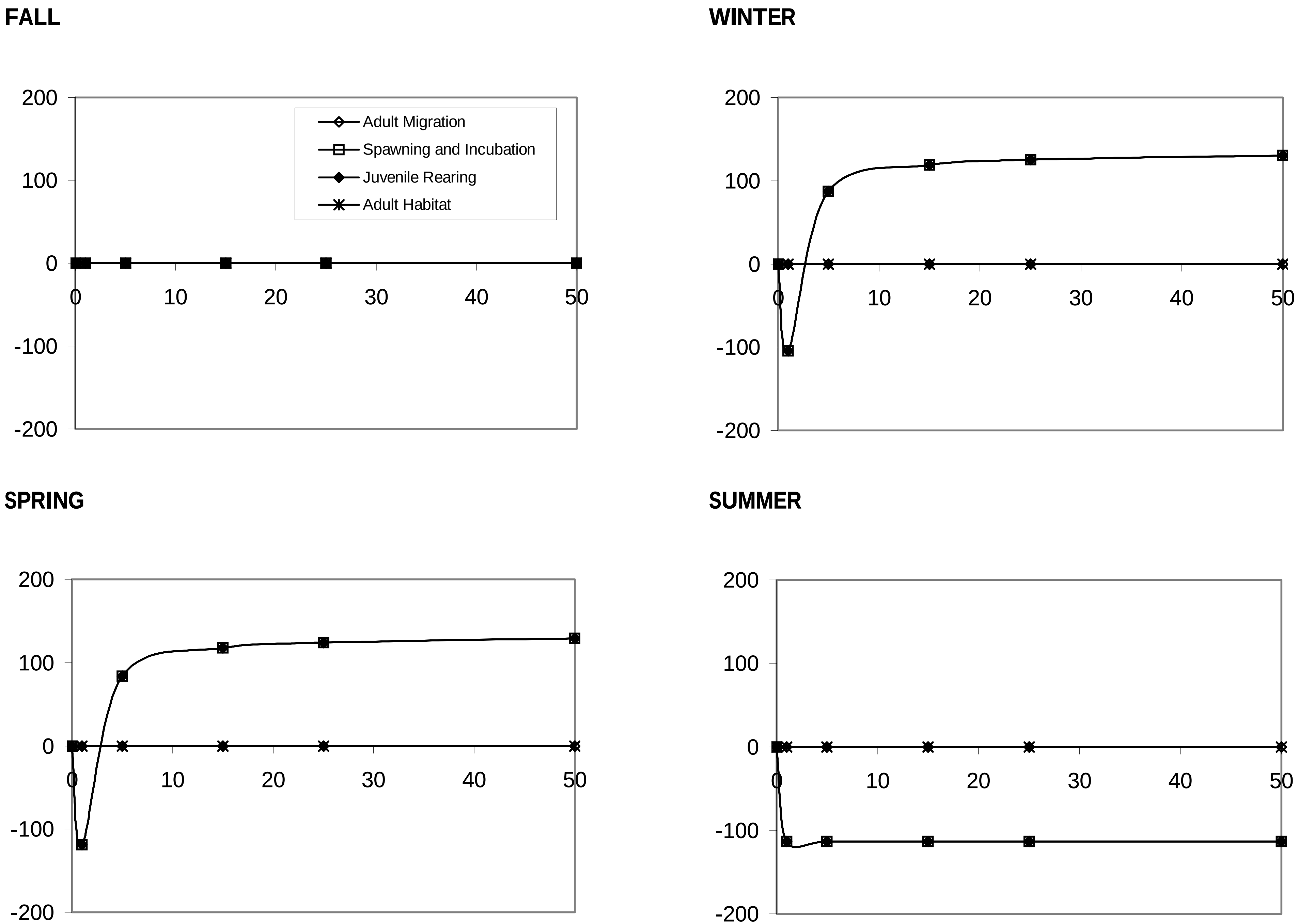


Figure I-30. SAM results showing bank-line weighted relative response (feet) for Delta smelt at Site RM 47.9R.

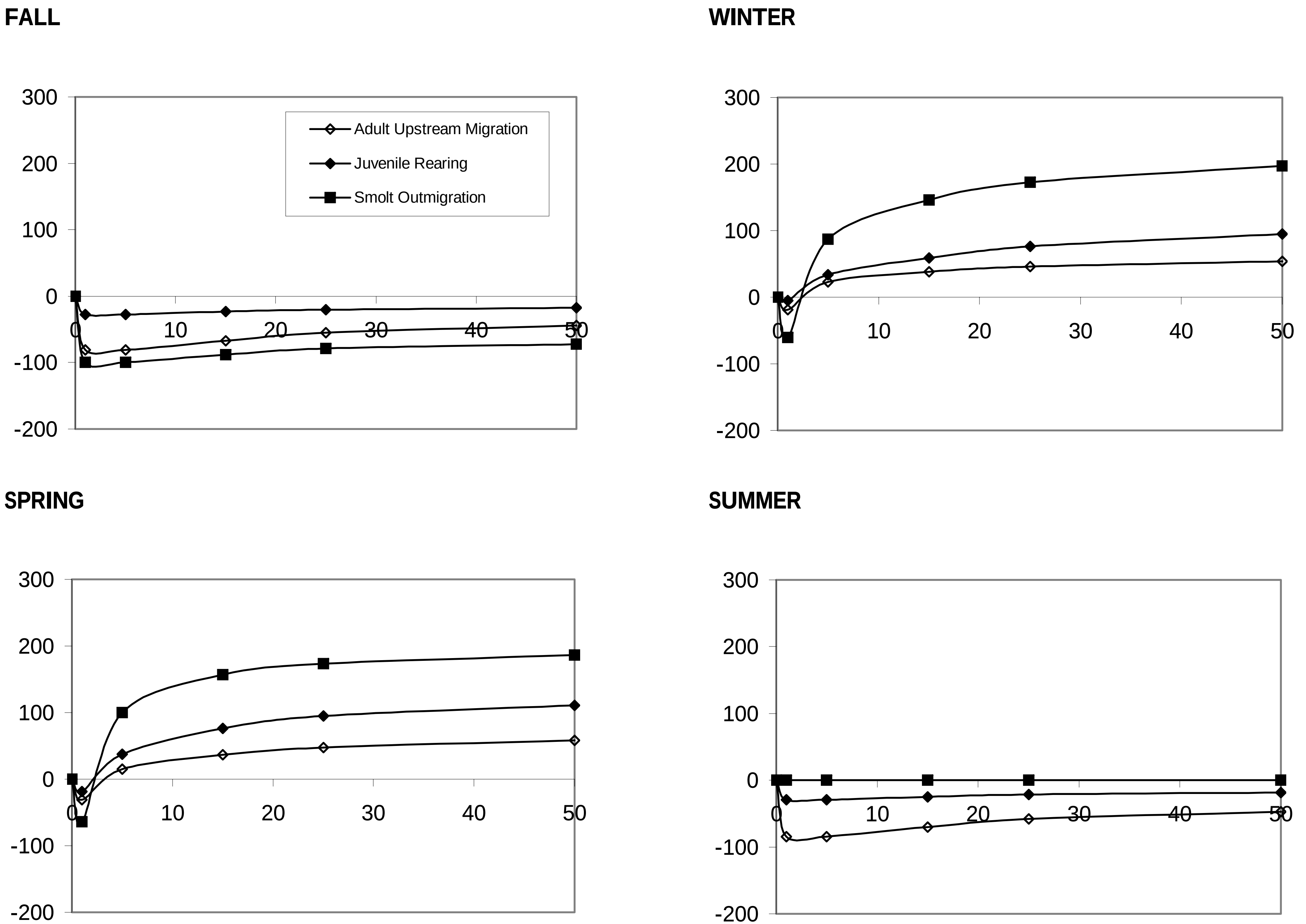


Figure I-31. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site RM 48.2R.

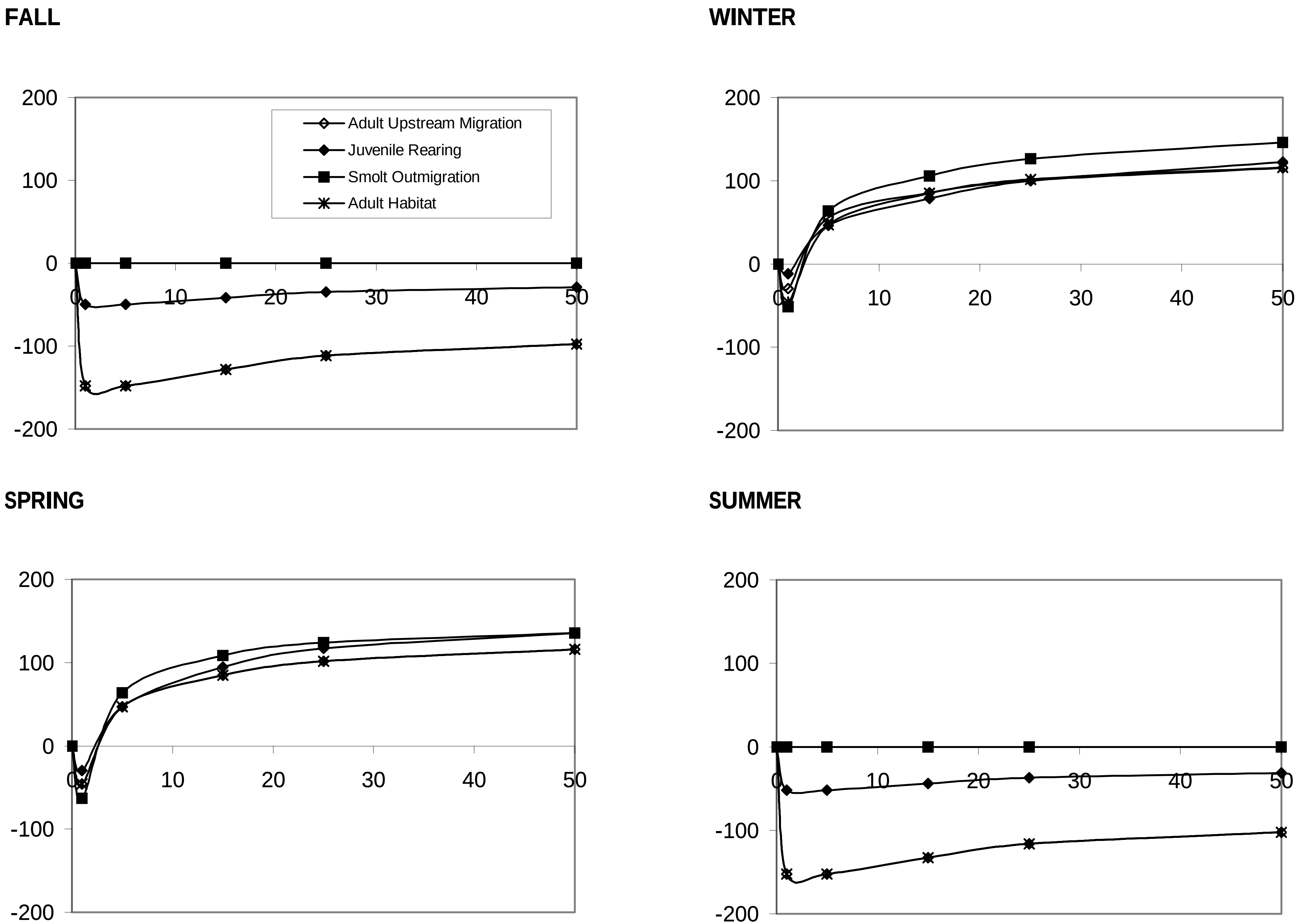


Figure I-32. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site RM 48.2R.

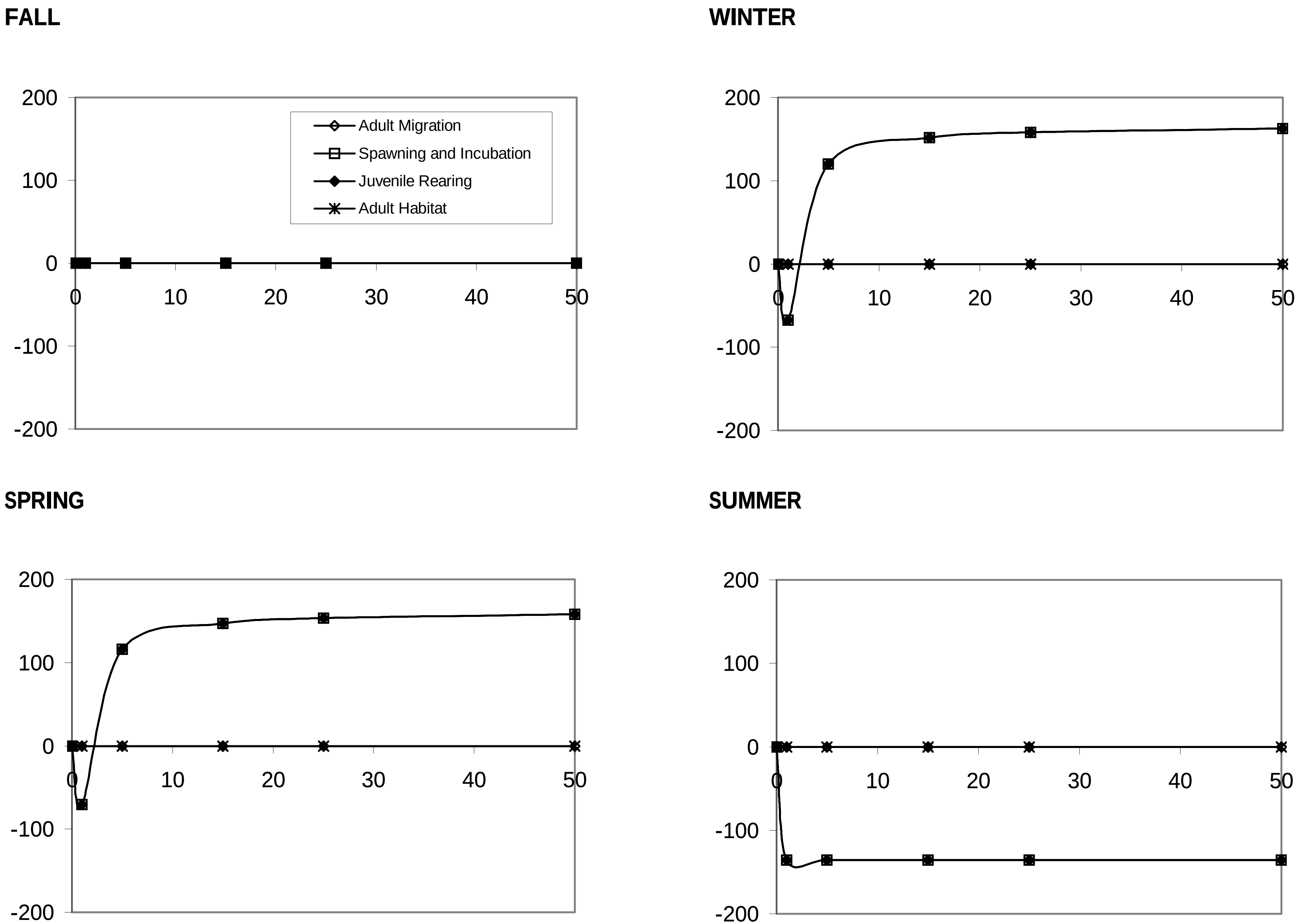


Figure I-33. SAM results showing bank-line weighted relative response (feet) for Delta smelt at Site RM 48.2R.

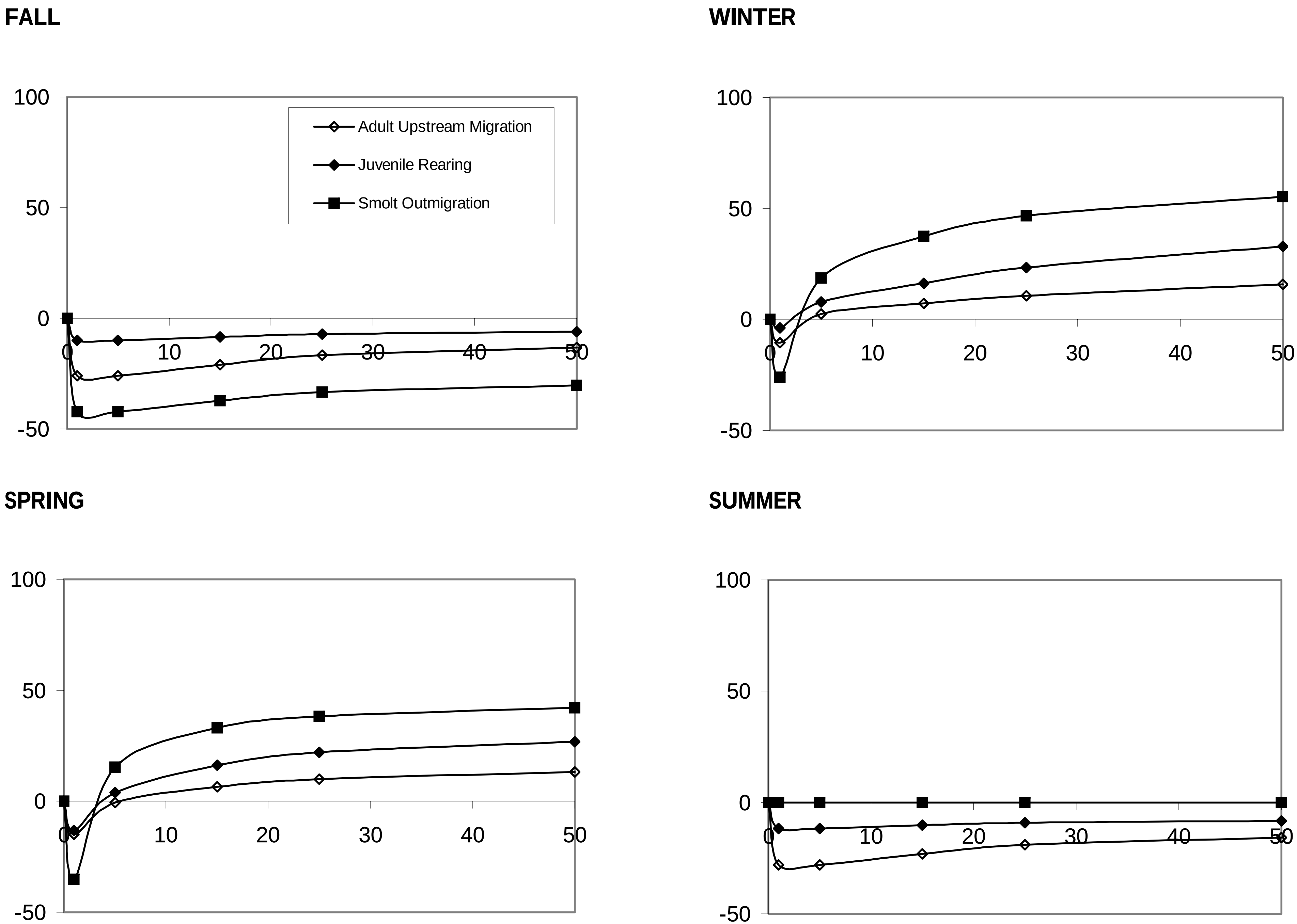


Figure I-34. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site RM 62.5R.

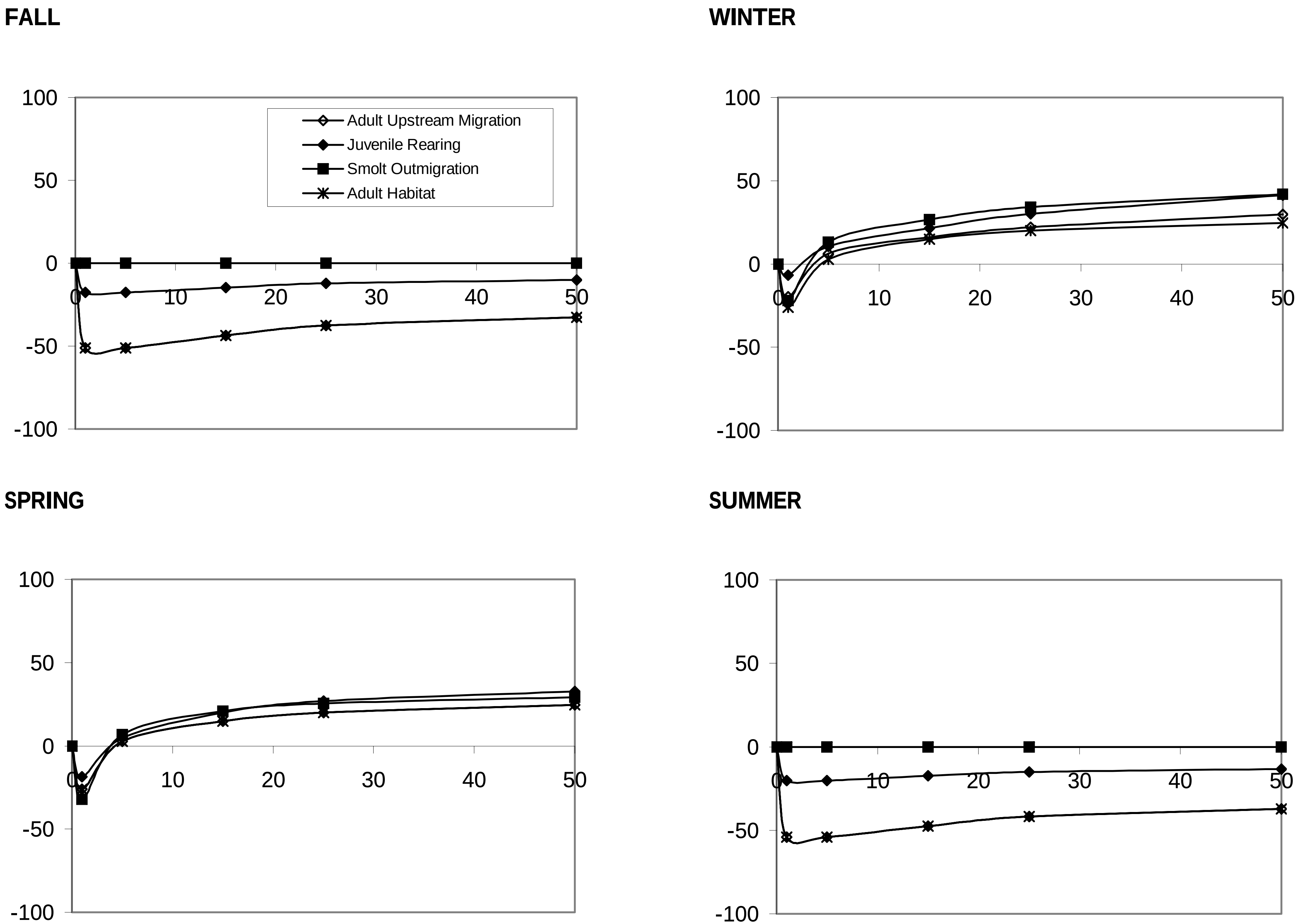


Figure I-35. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site RM 62.5R.

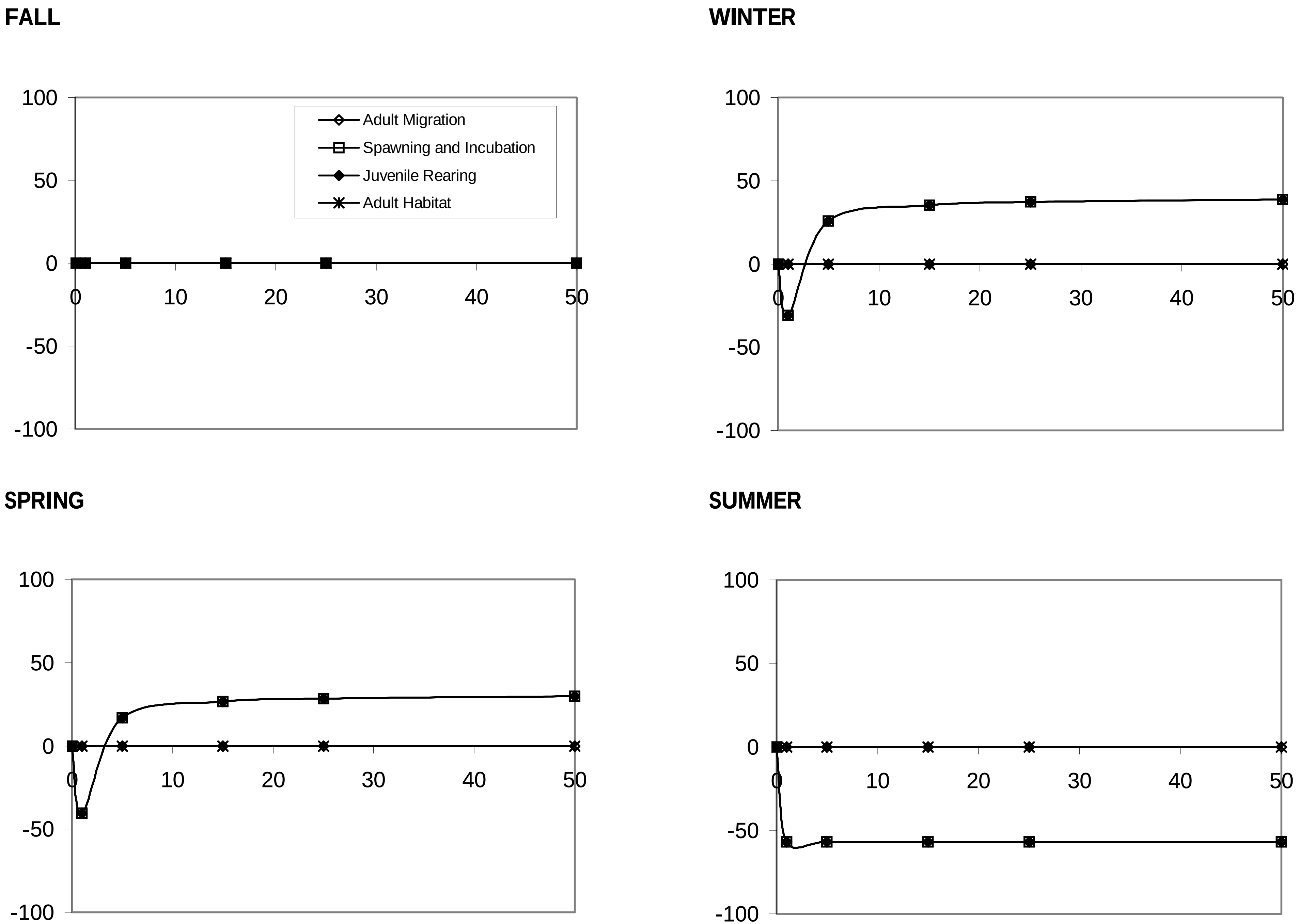


Figure I-36. SAM results showing bank-line weighted relative response (feet) for Delta smelt at Site RM 62.5R.

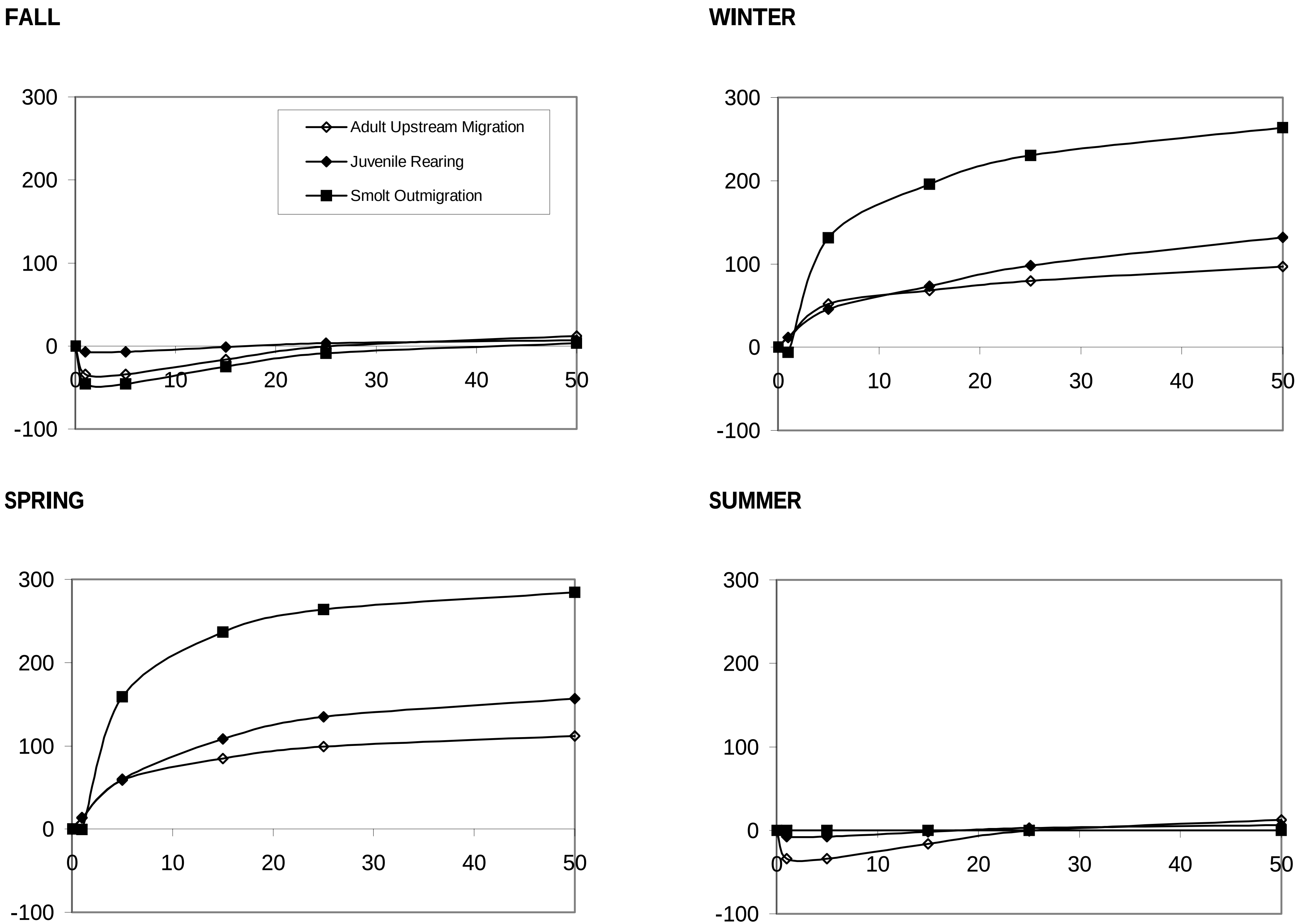


Figure I-37. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site RM 68.9L.

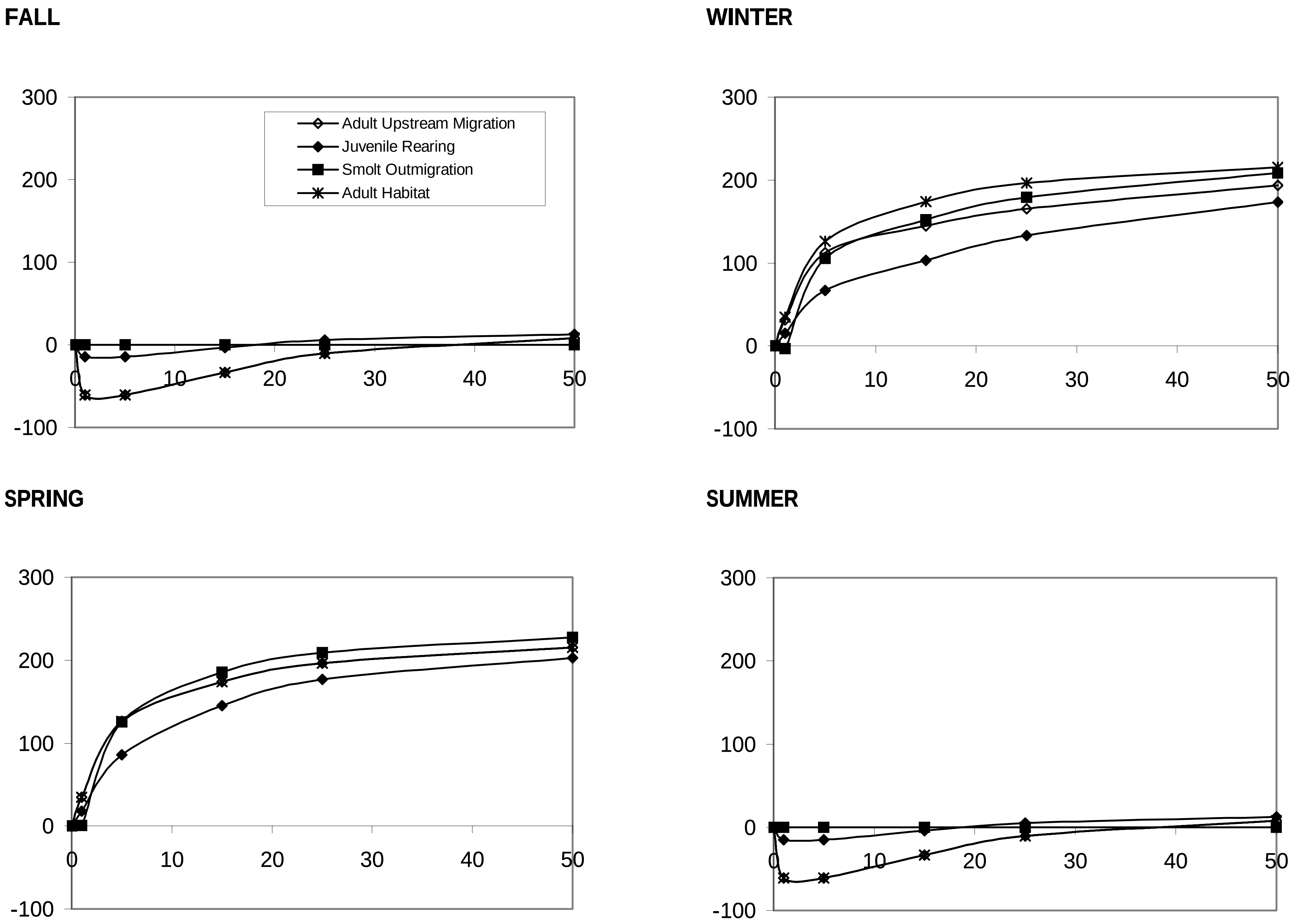


Figure I-38. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site RM 68.9L.

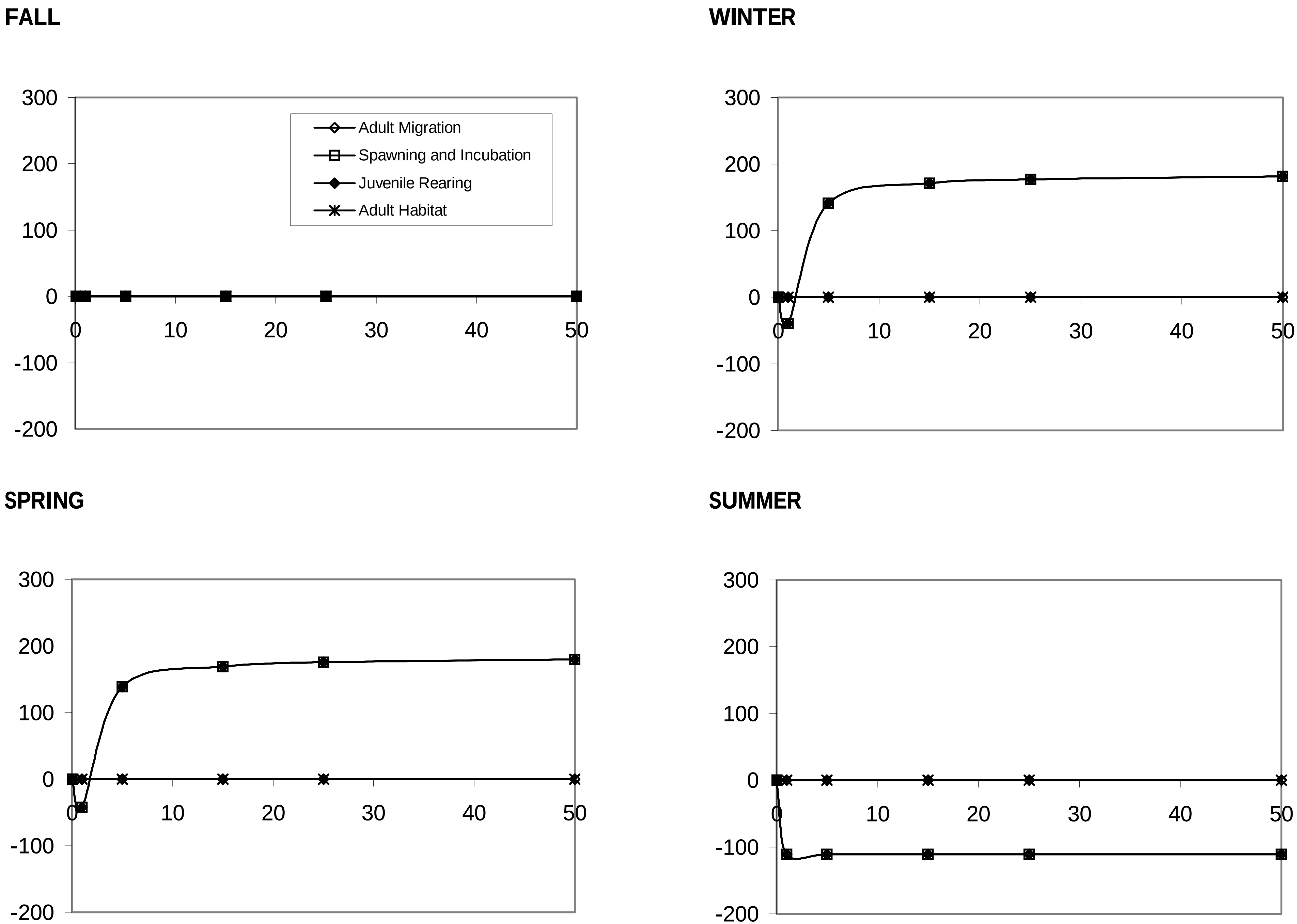


Figure I-39. **SAM results showing bank-line weighted relative response (feet) for Delta smelt at Site RM 68.9L.**

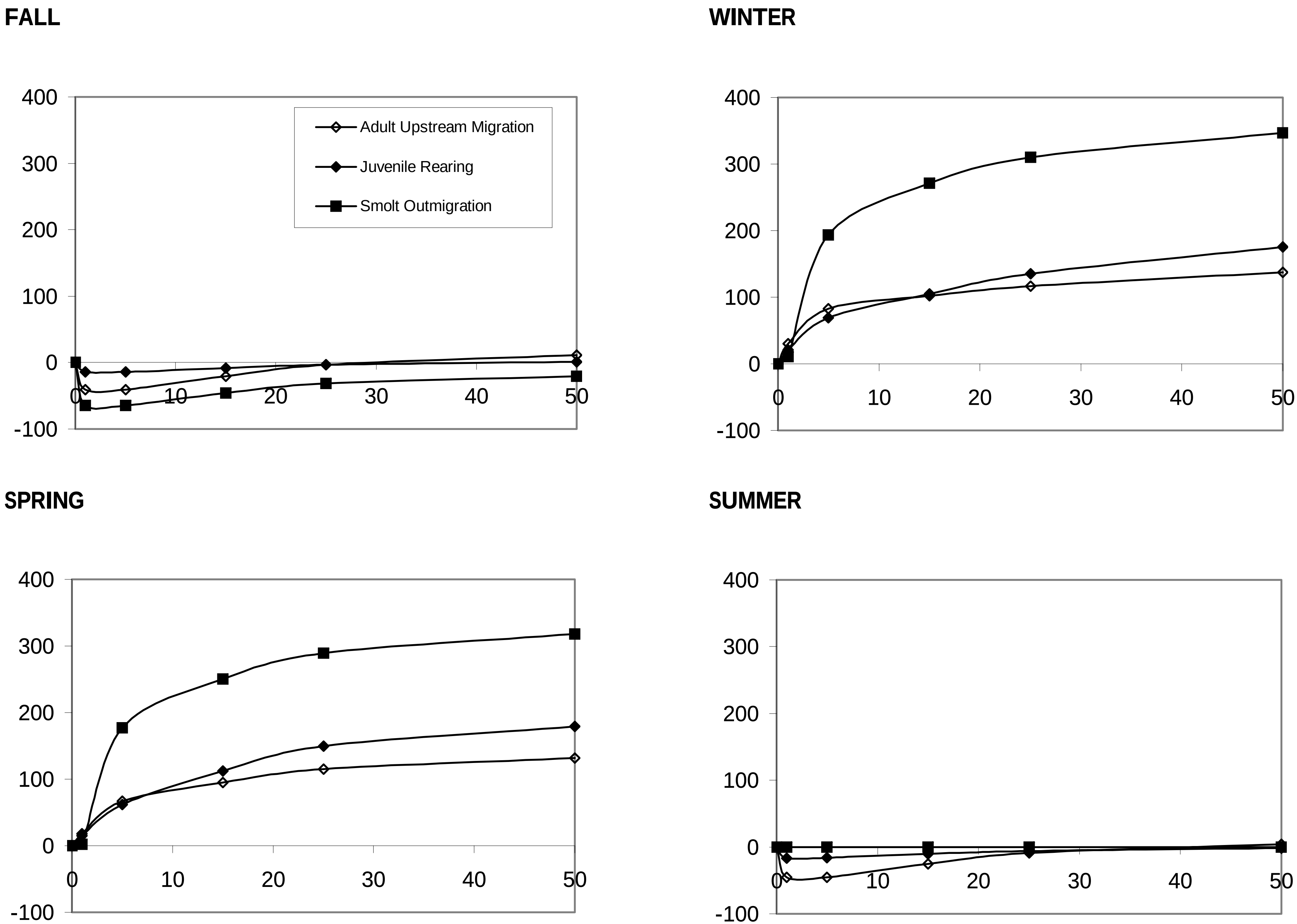


Figure I-40. SAM results showing bank-line weighted relative response (feet) for Chinook salmon (Winter-run shown) at Site RM 78.0L.

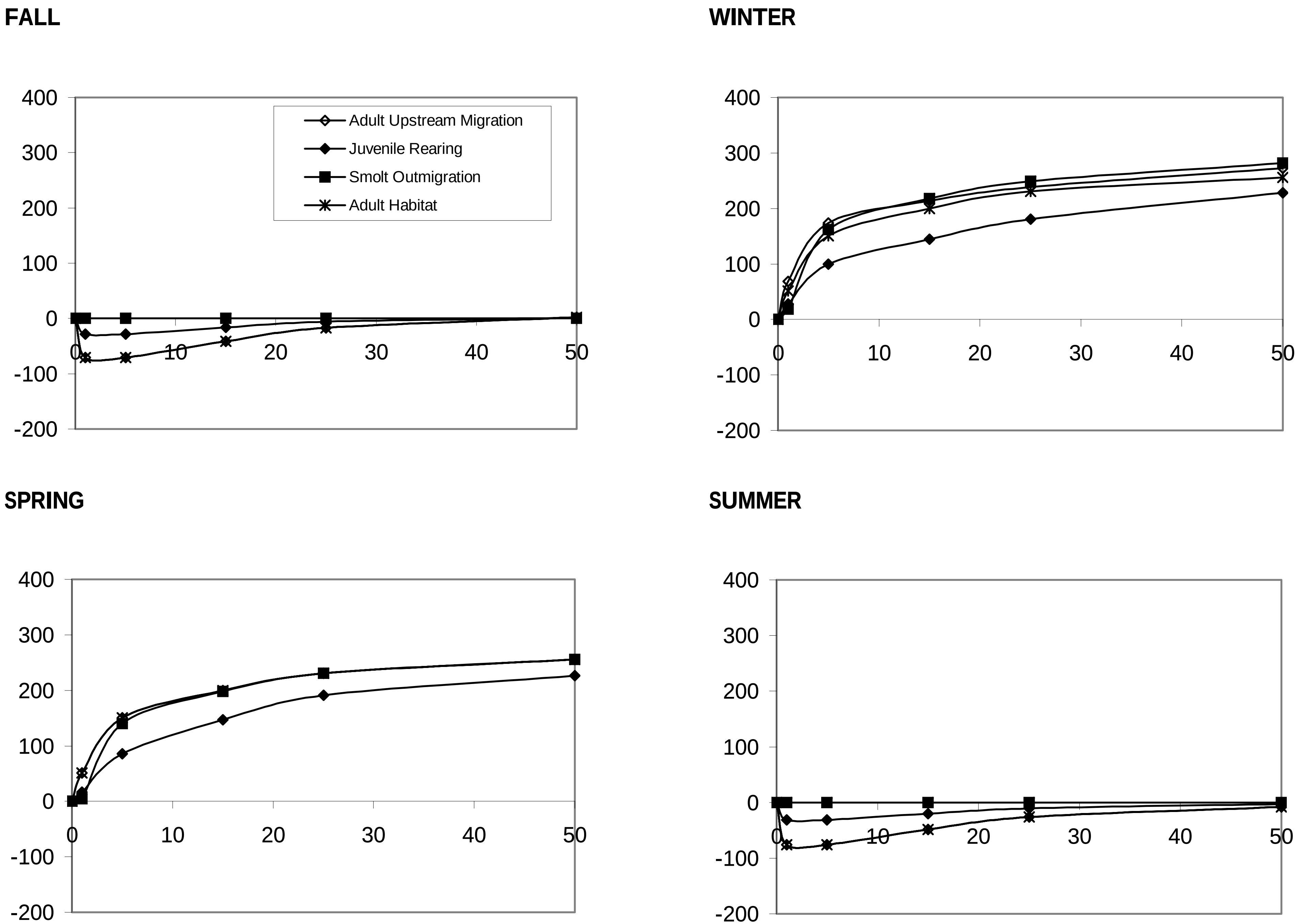


Figure I-41. SAM results showing bank-line weighted relative response (feet) for Central Valley steelhead at Site RM 78.0L.

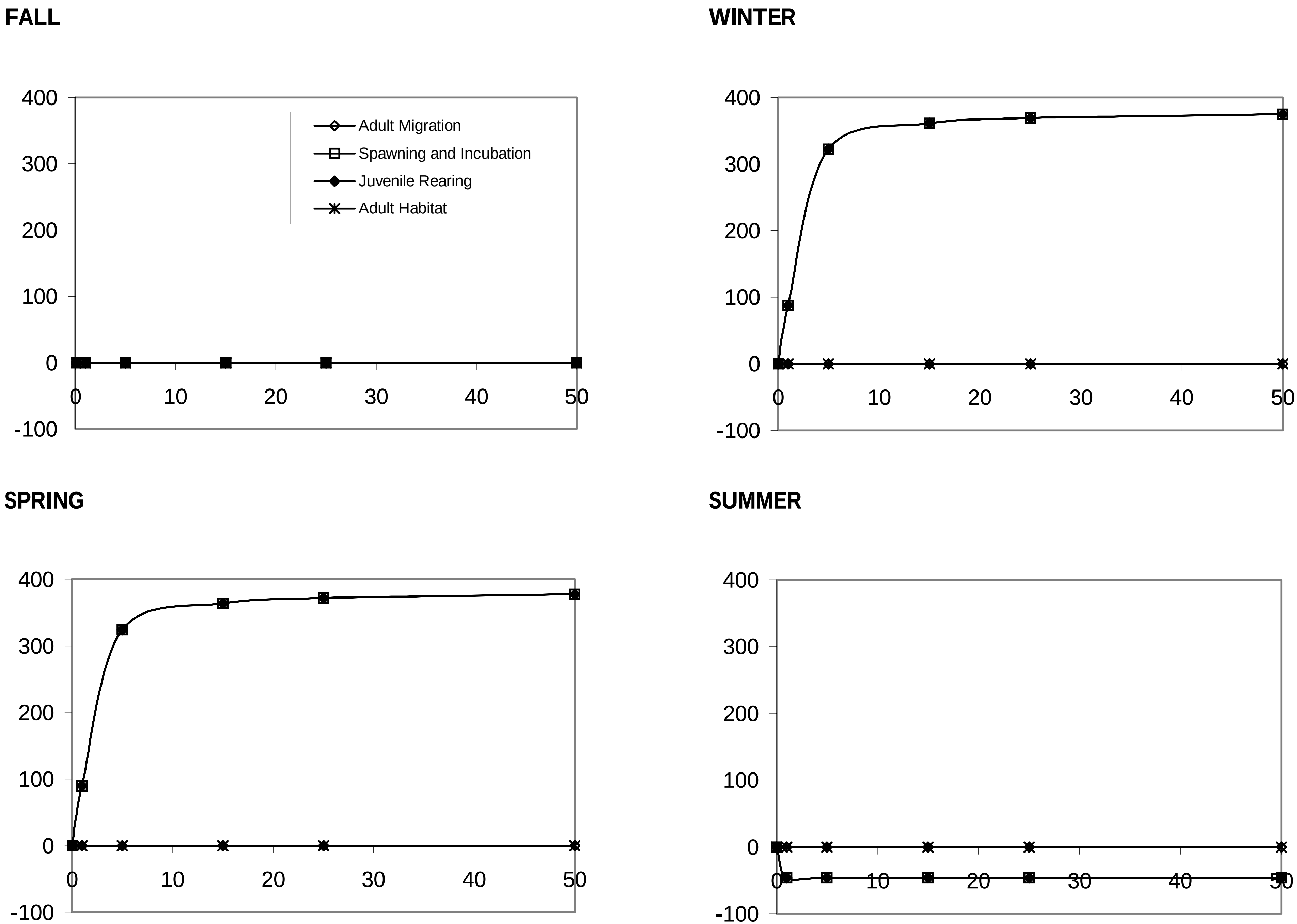


Figure I-42. SAM results showing bank-line weighted relative response (feet) for Delta smelt at Site RM 78.0L.

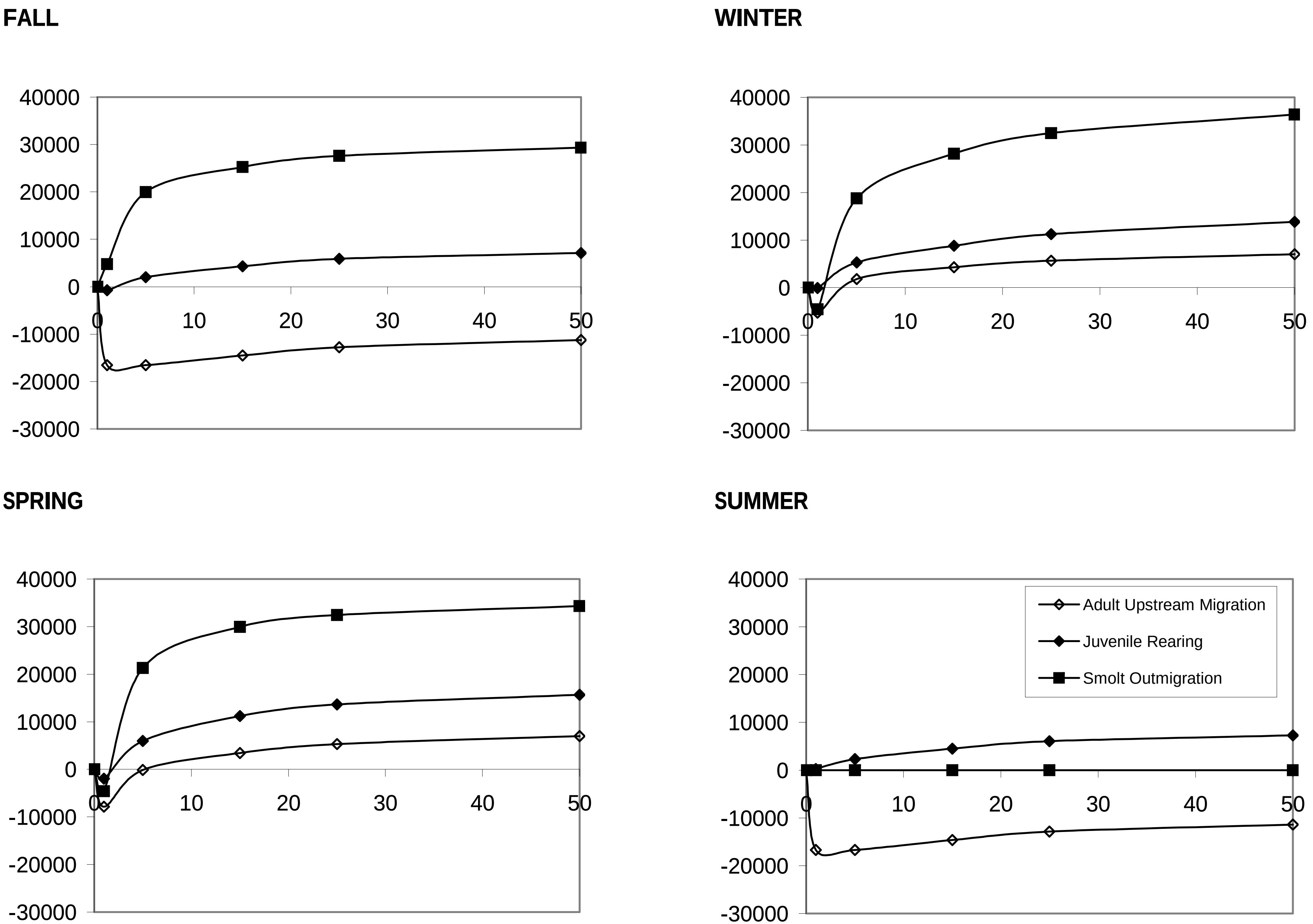


Figure I-43. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site RM 16.9L.

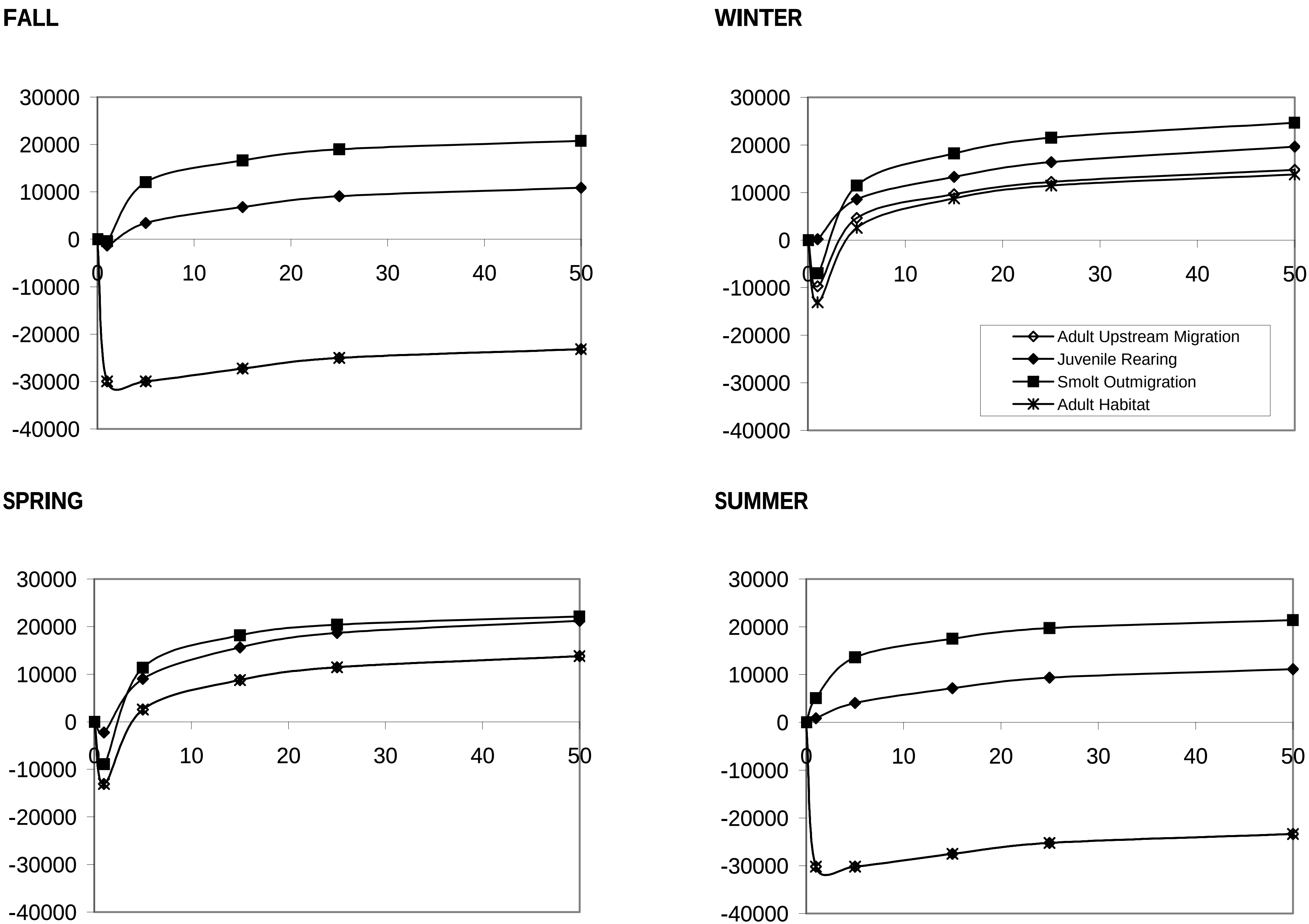


Figure I-44. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site RM 16.9L.

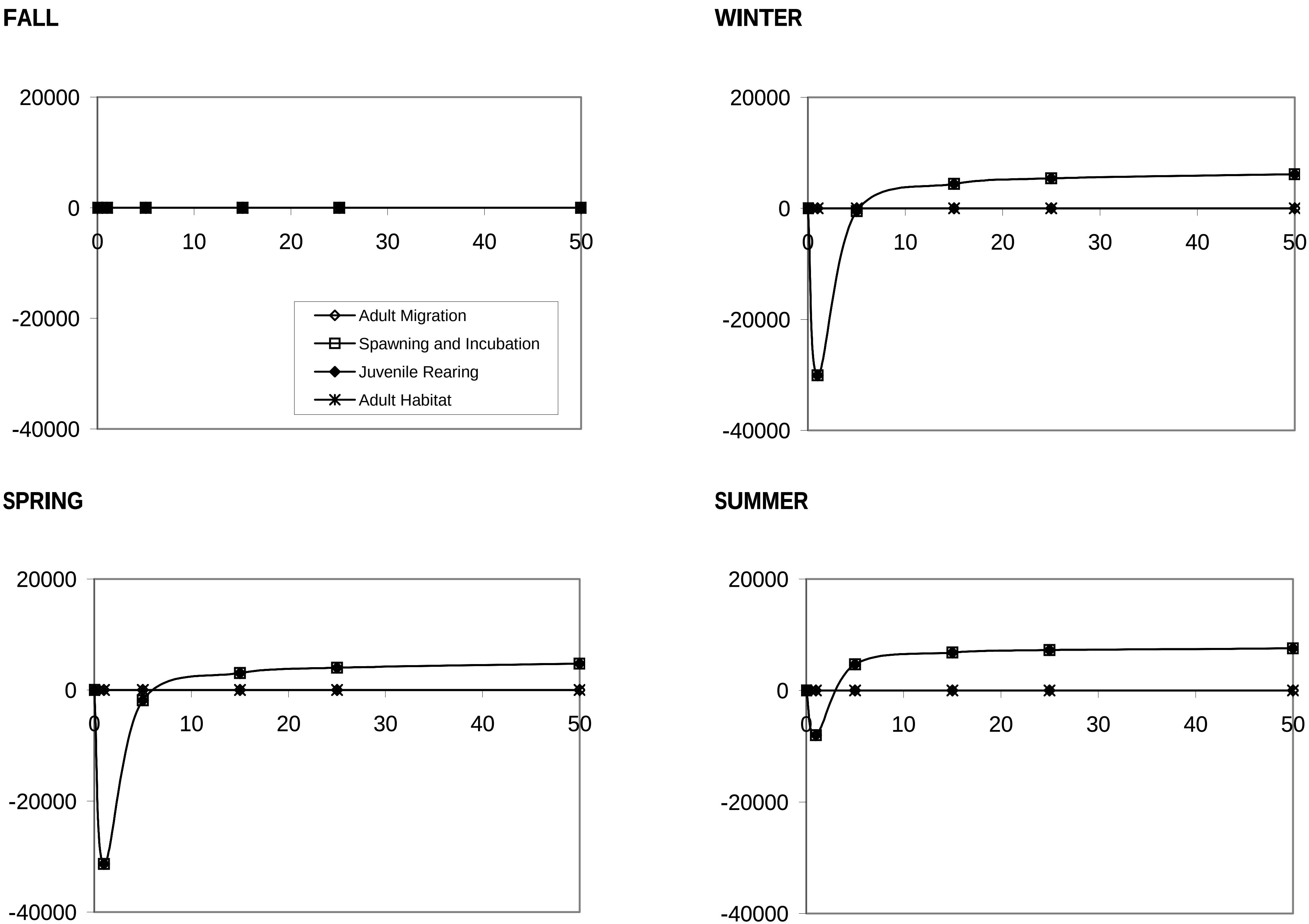


Figure I-45. SAM results showing wetted-area weighted relative response (square feet) for Delta smelt at Site RM 16.9L.

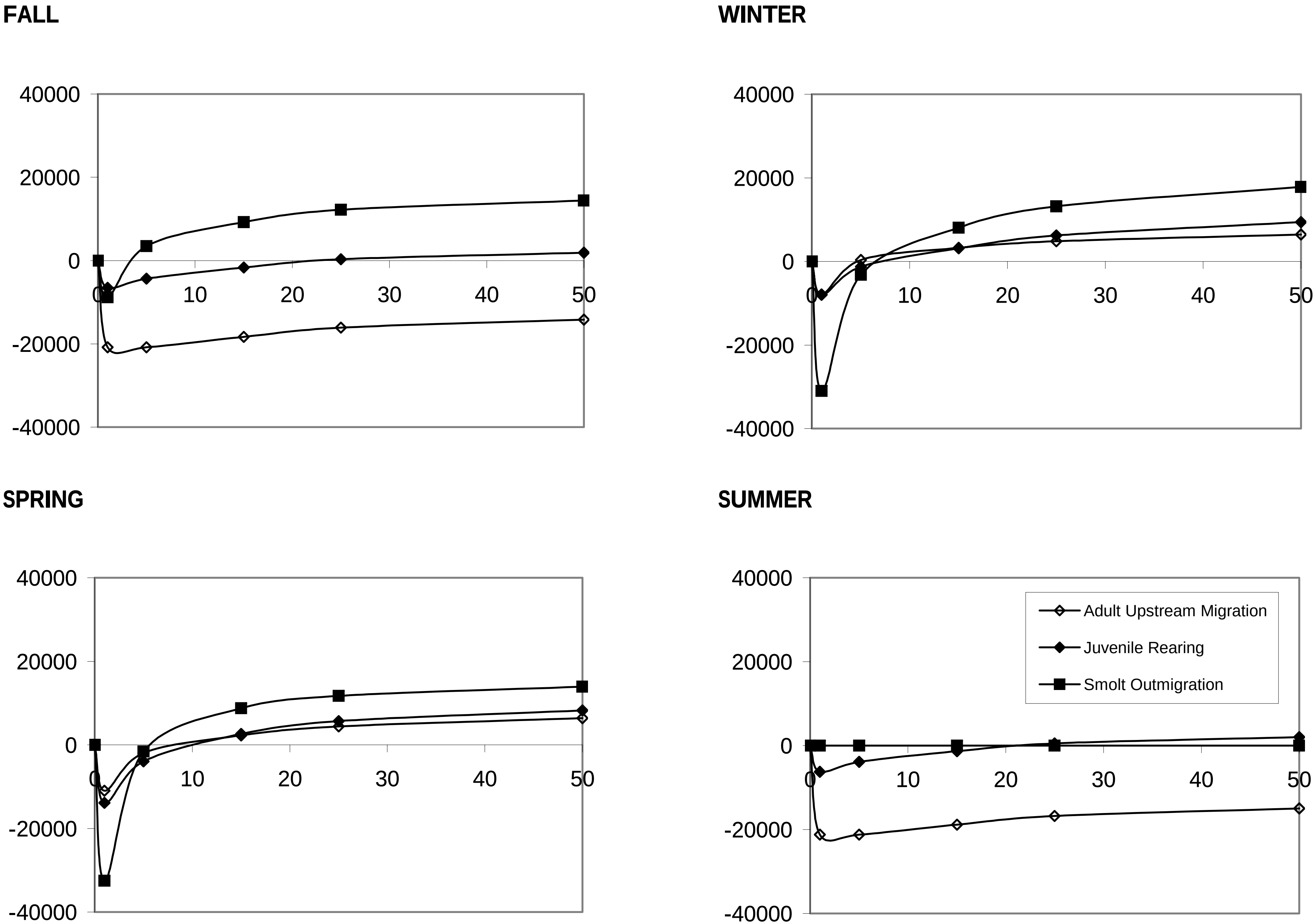


Figure I-46. **SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site RM 19.0R.**

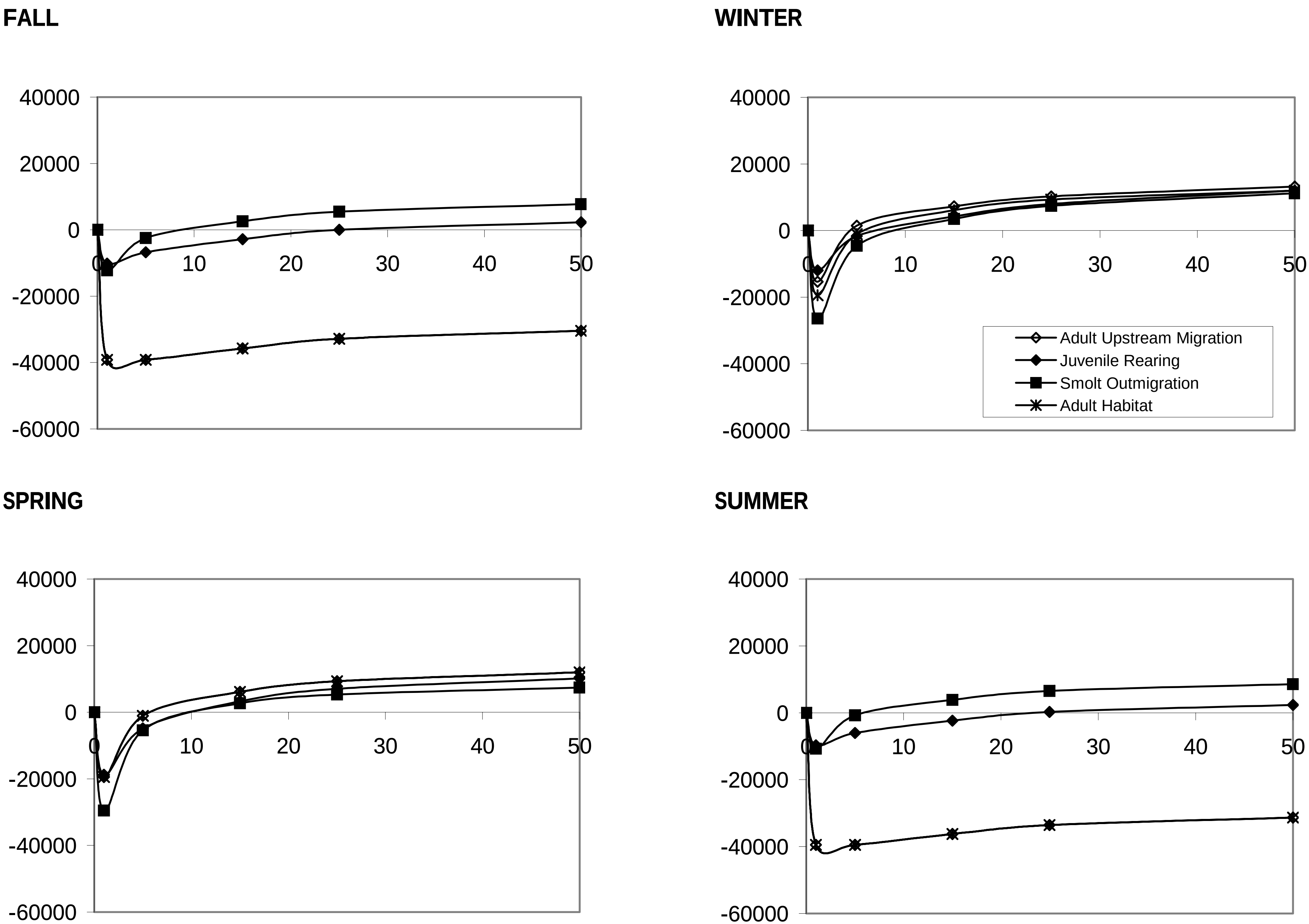


Figure I-47. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site RM 19.0R.

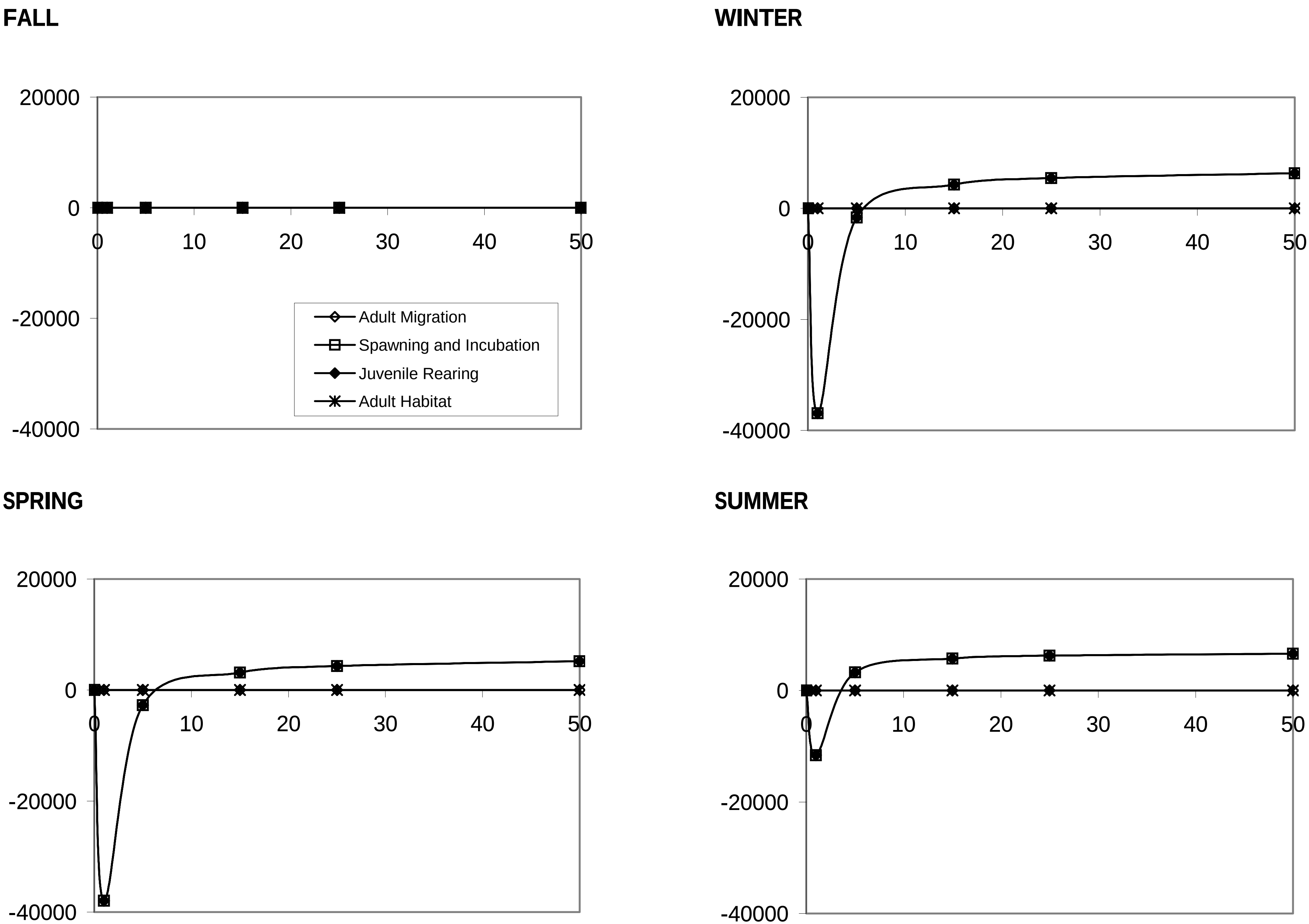


Figure I-48. SAM results showing wetted-area weighted relative response (square feet) for Delta smelt at Site RM 19.0R.

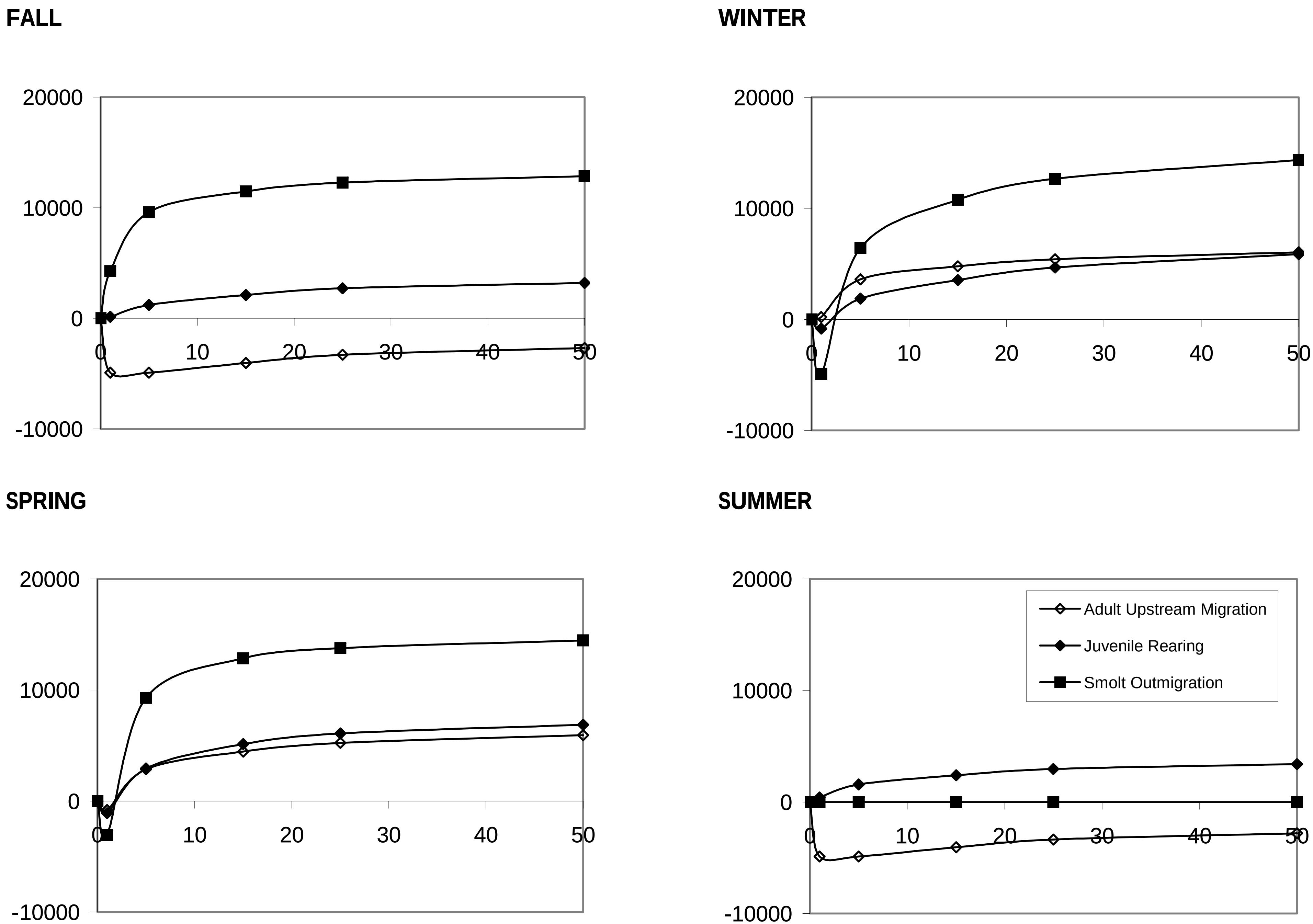


Figure I-49. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site RM 19.4R.

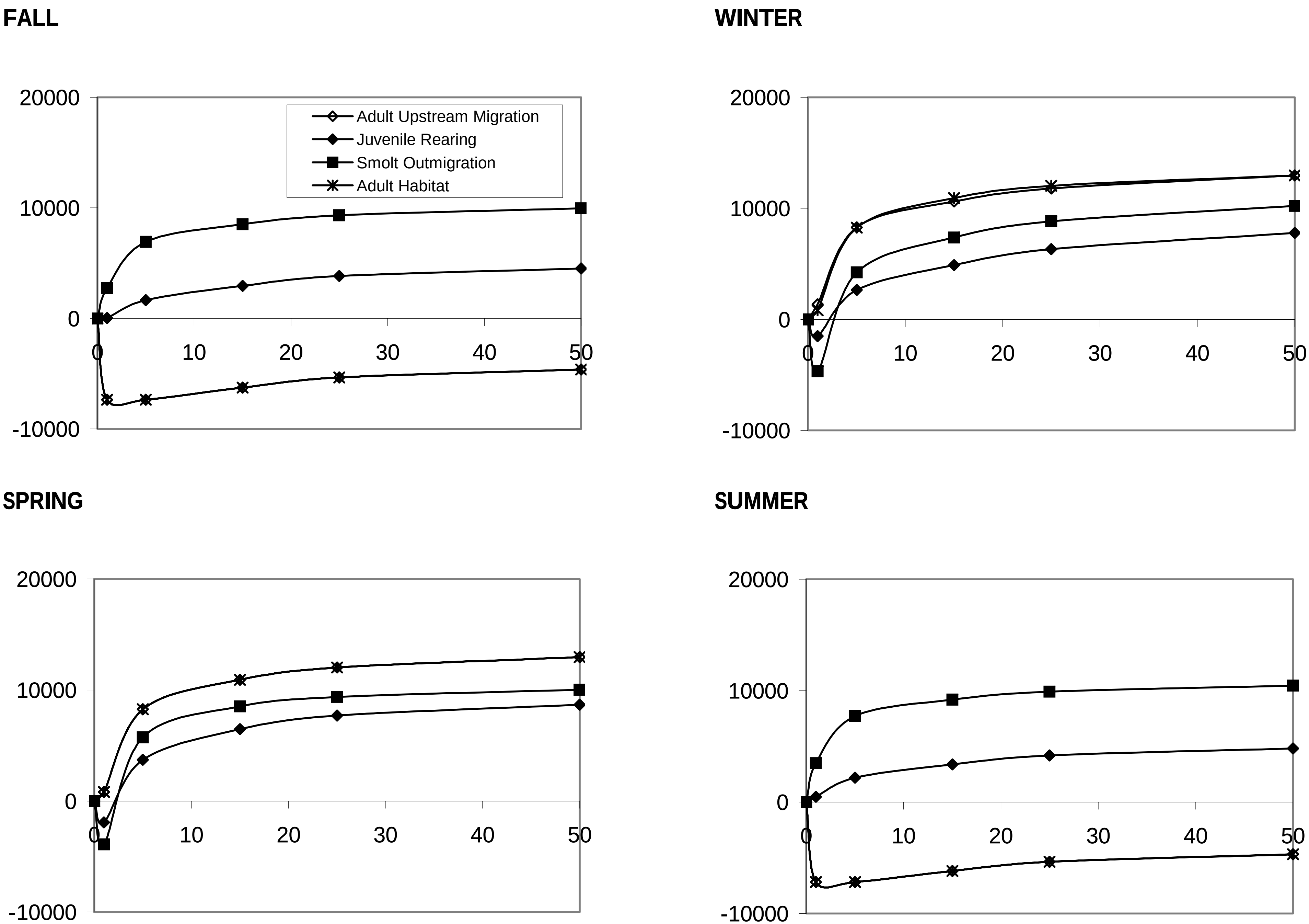


Figure I-50. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site RM 19.4R.

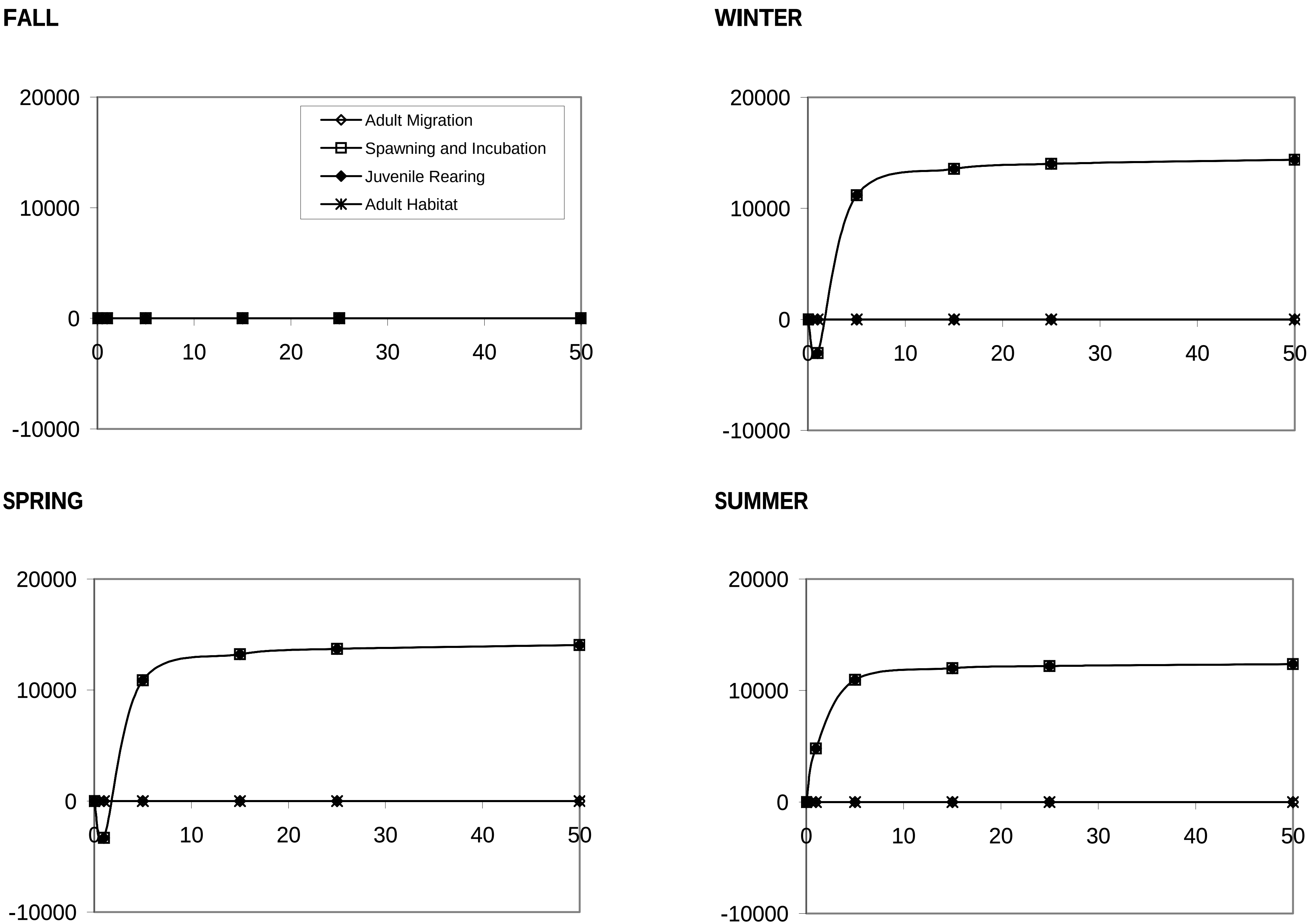


Figure I-51. SAM results showing wetted-area weighted relative response (square feet) for Delta smelt at Site RM 19.4R.

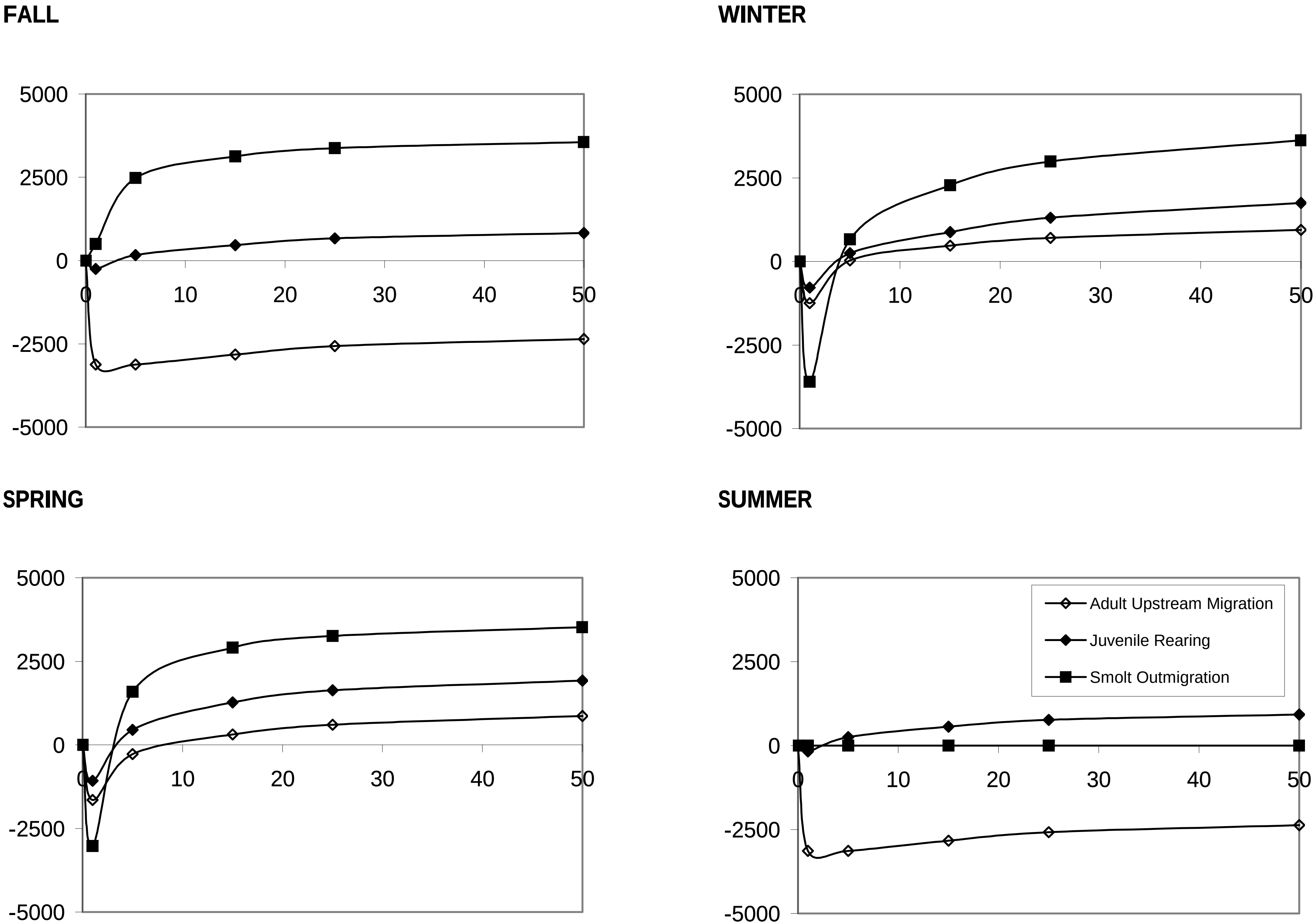


Figure I-52. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site RM 22.7R.

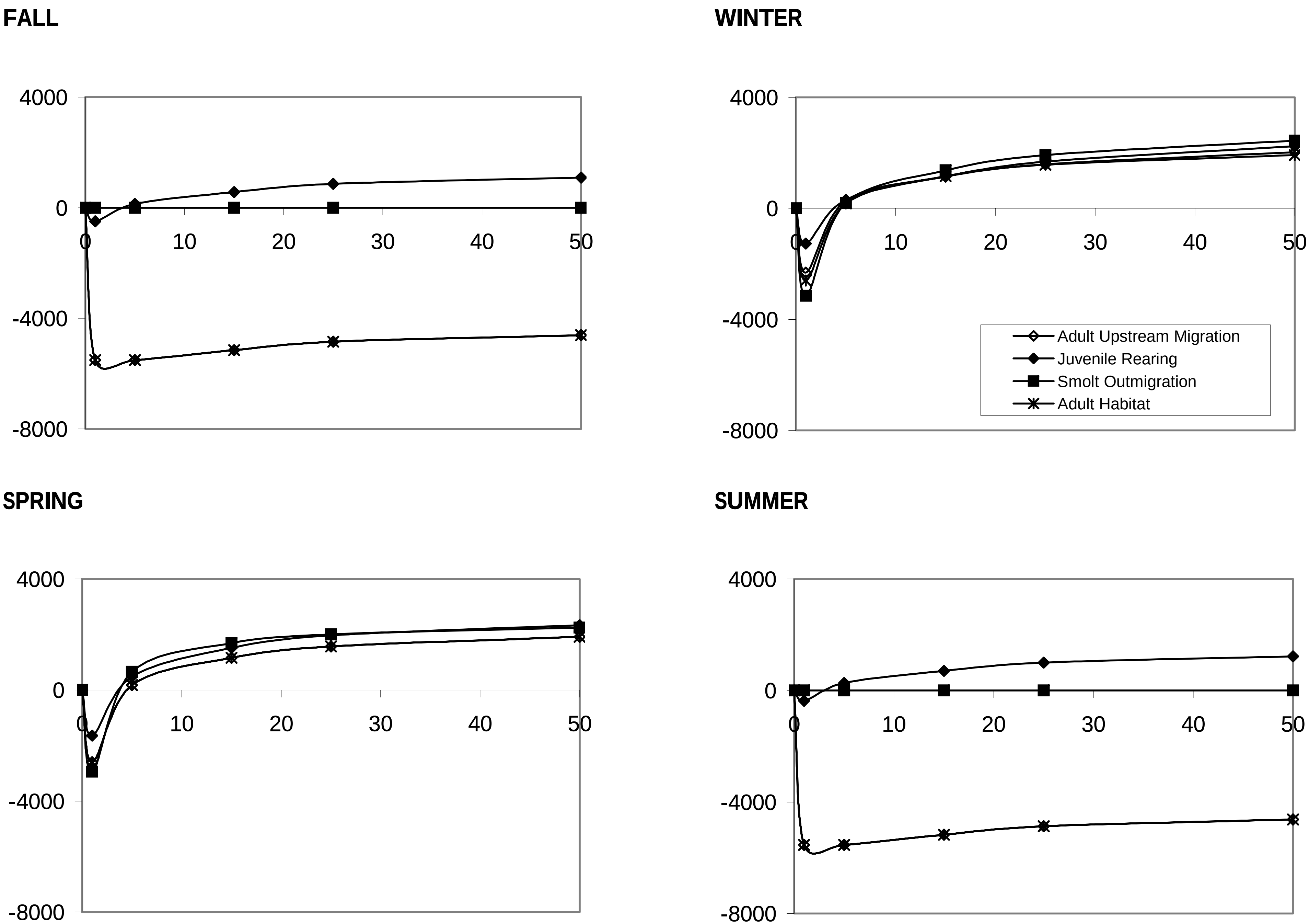


Figure I-53. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site RM 22.7R.

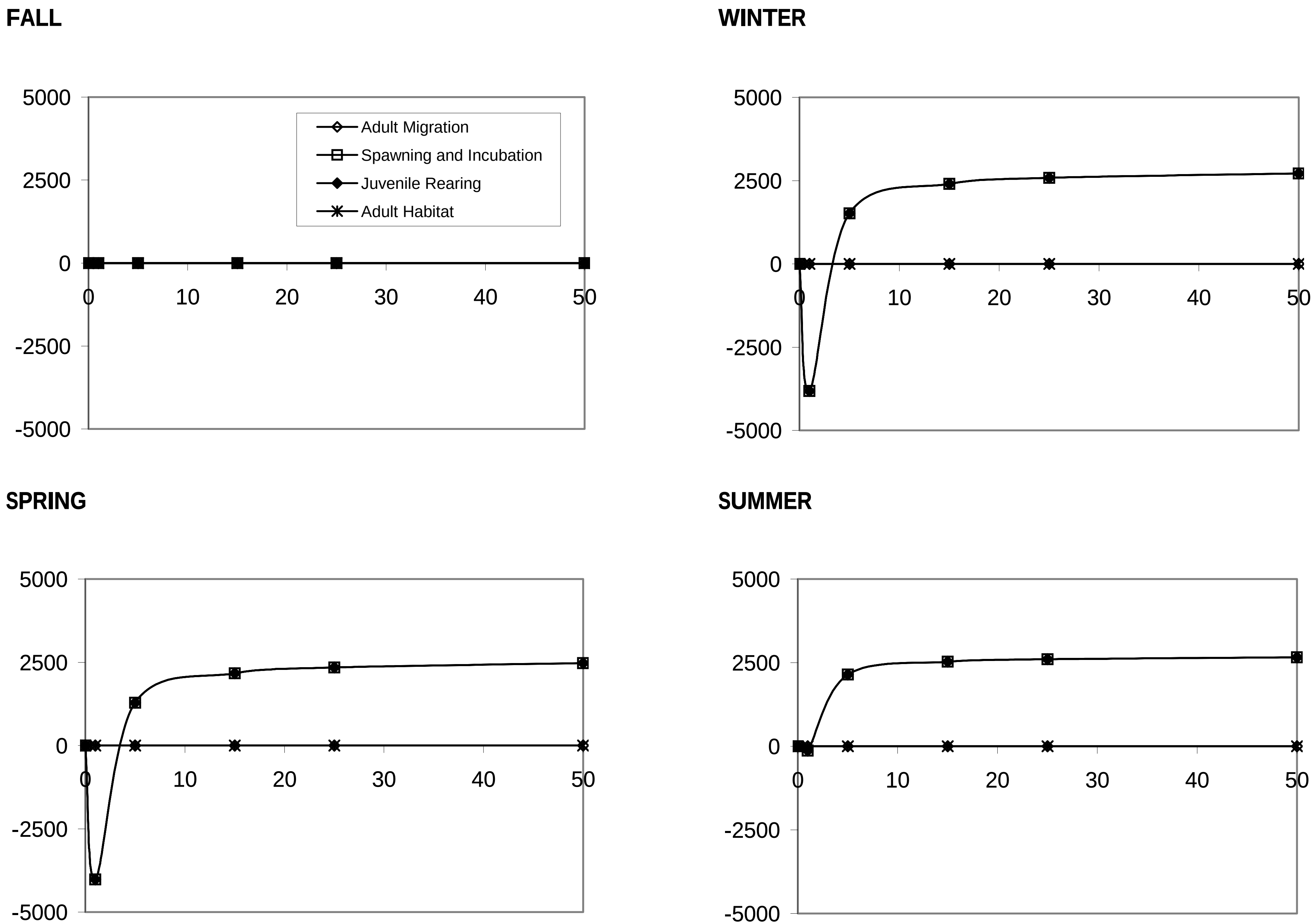


Figure I-54. SAM results showing wetted-area weighted relative response (square feet) for Delta smelt at Site 22.7R.

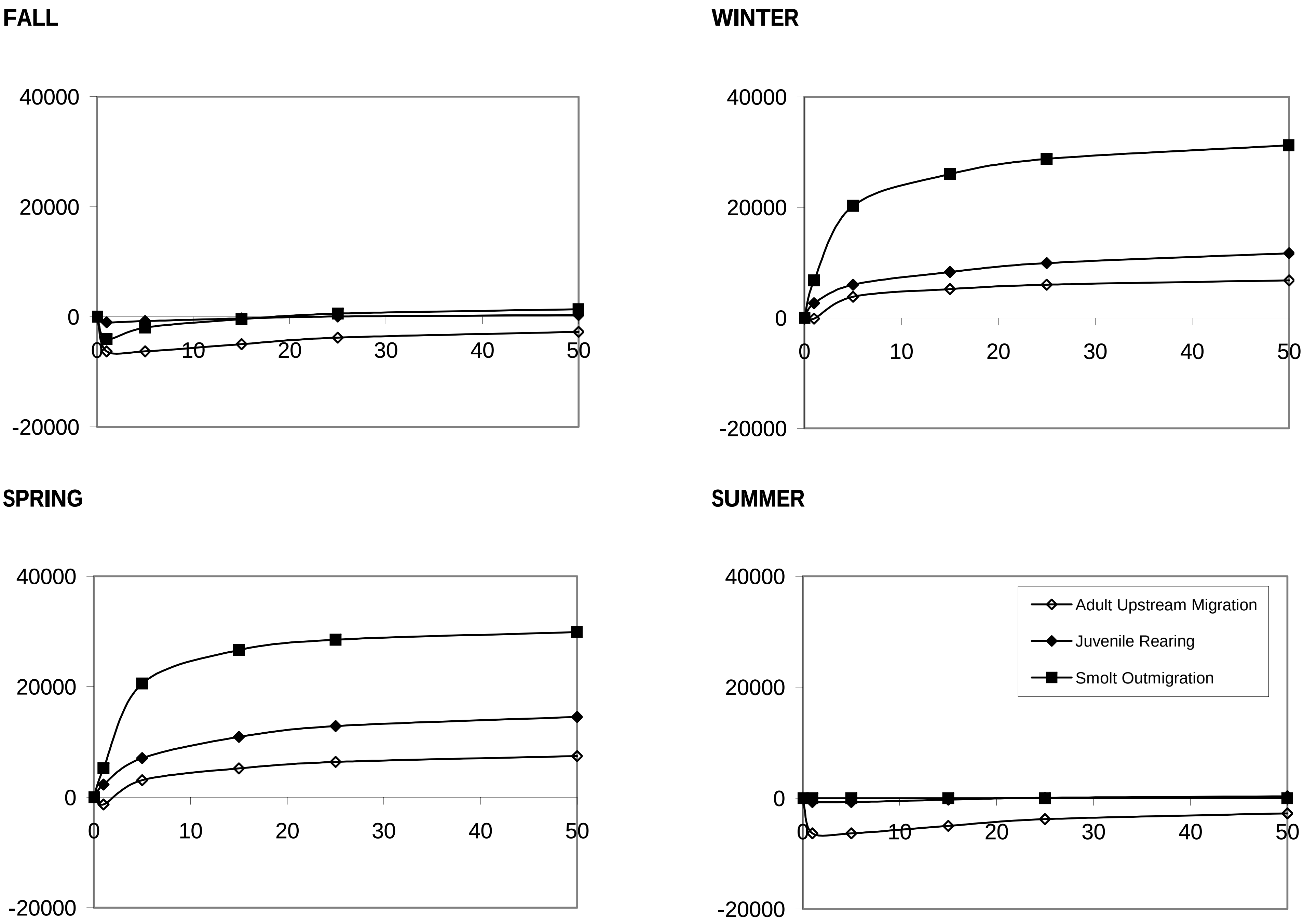


Figure I-55. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site RM 33.0R.

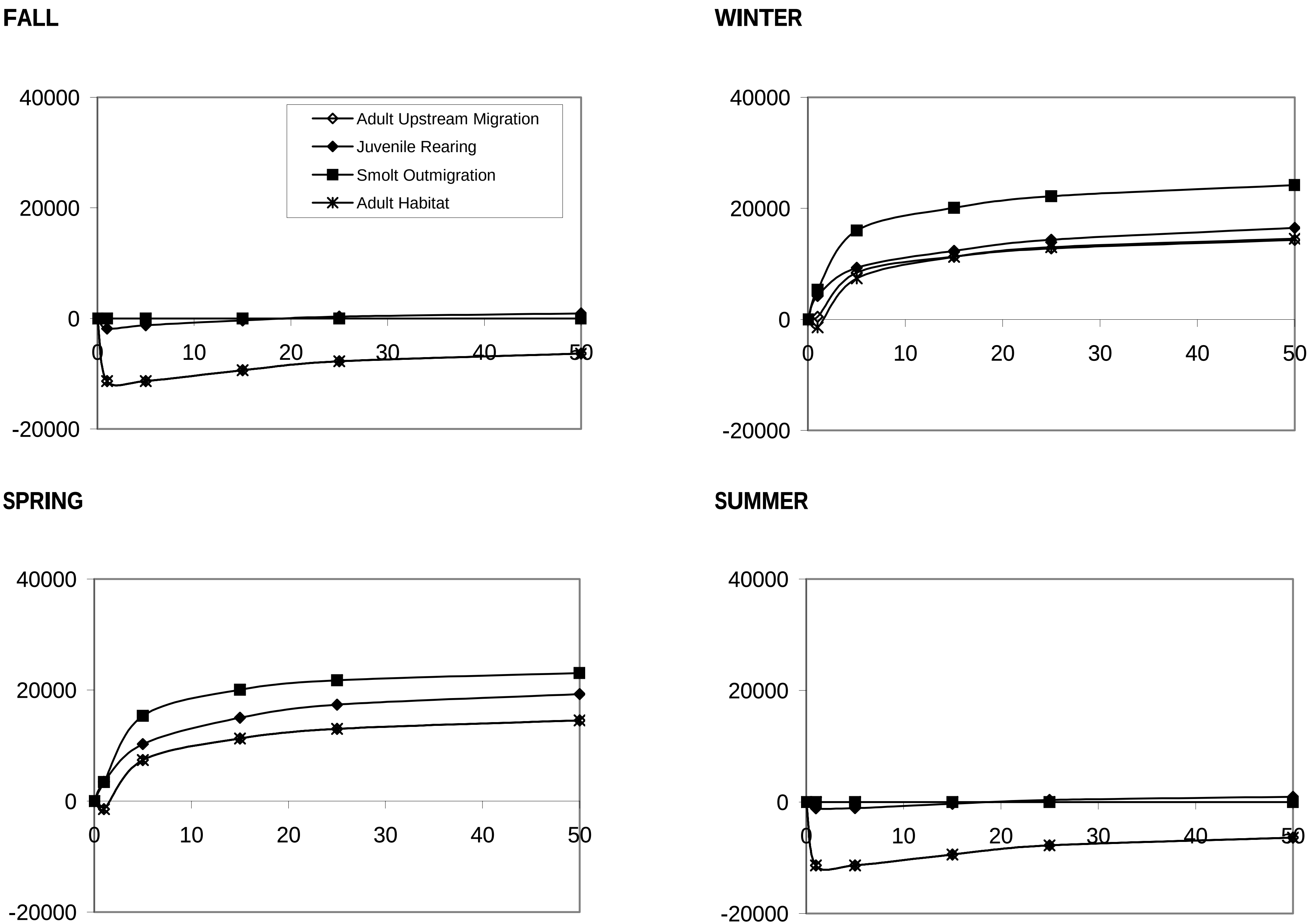


Figure I-56. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site RM 33.0R.

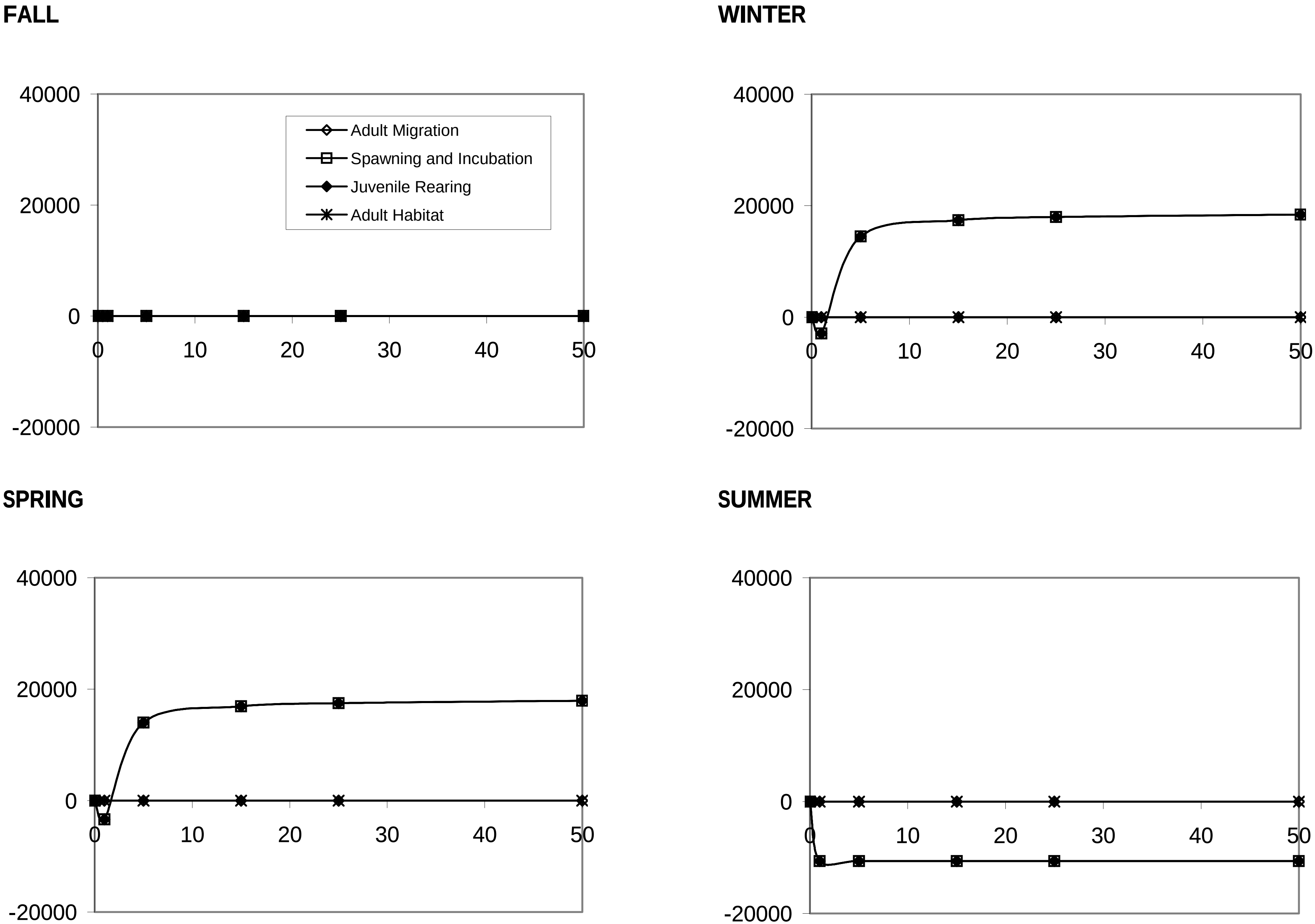


Figure I-57. SAM results showing wetted-area weighted relative response (square feet) for Delta smelt at Site RM 33.0R.

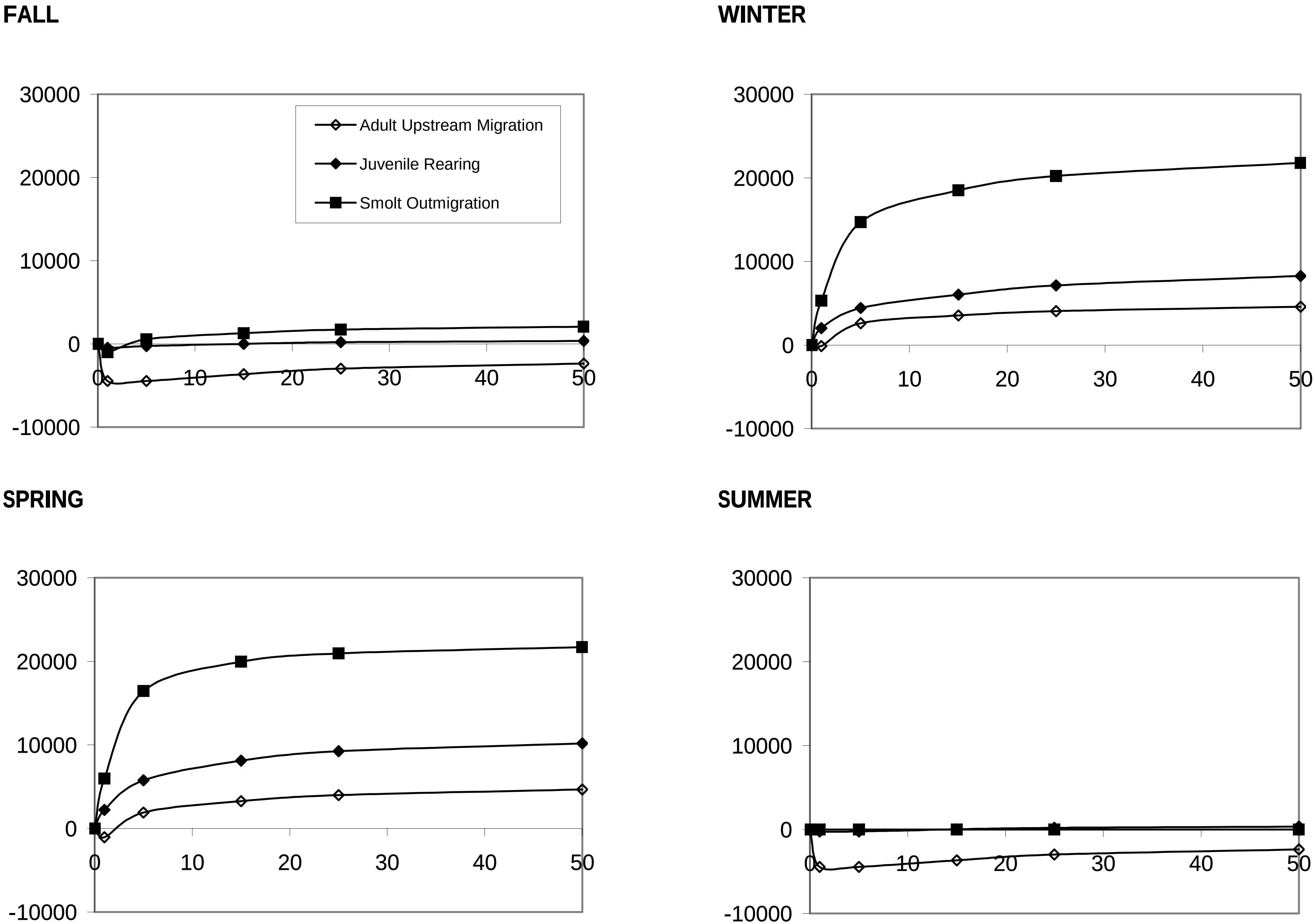


Figure I-58. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site RM 33.3R.

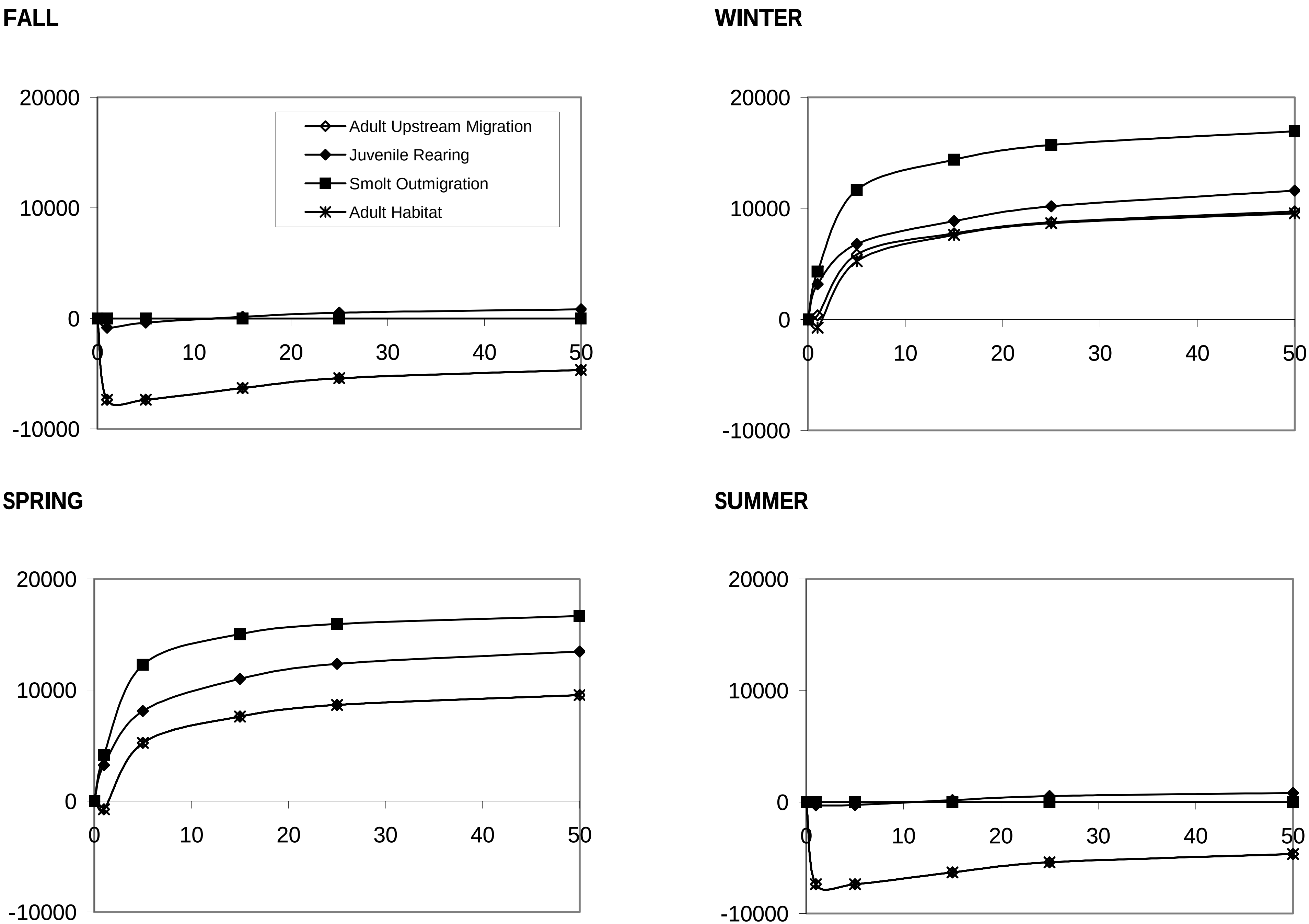


Figure I-59. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site RM 33.3R.

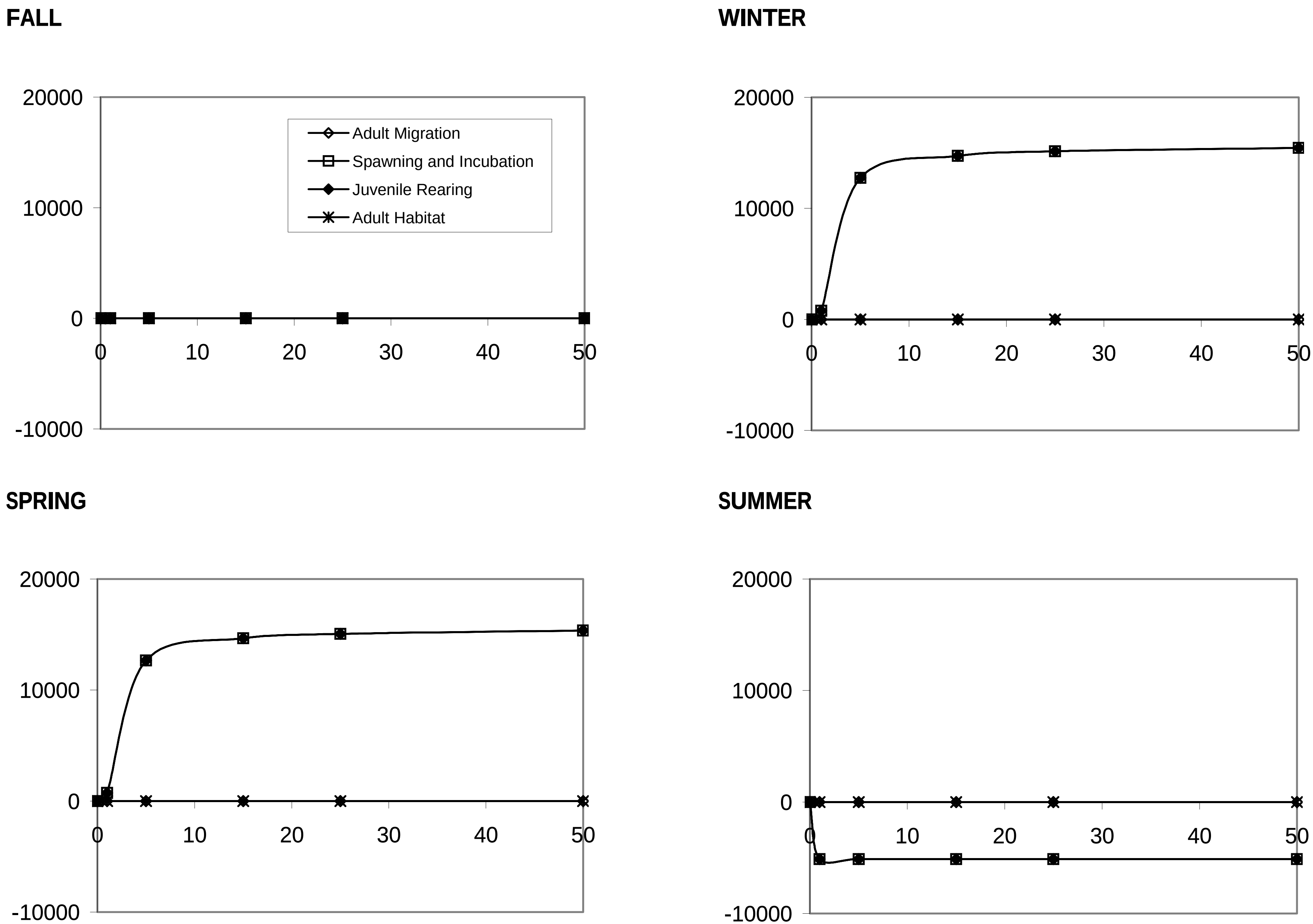


Figure I-60. SAM results showing wetted-area weighted relative response (square feet) for Delta smelt at Site RM 33.3R.

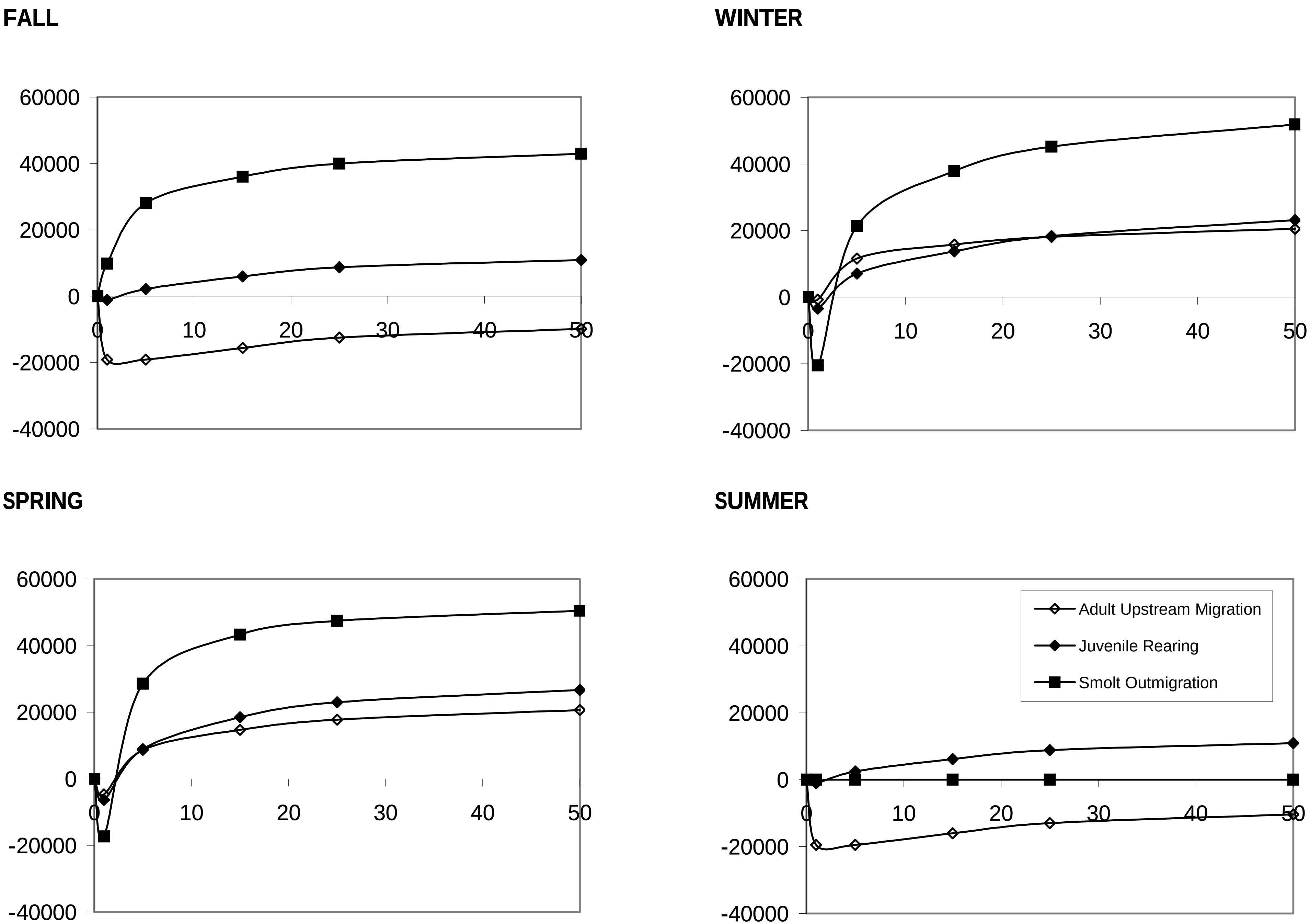


Figure I-61. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site RM 43.7R.

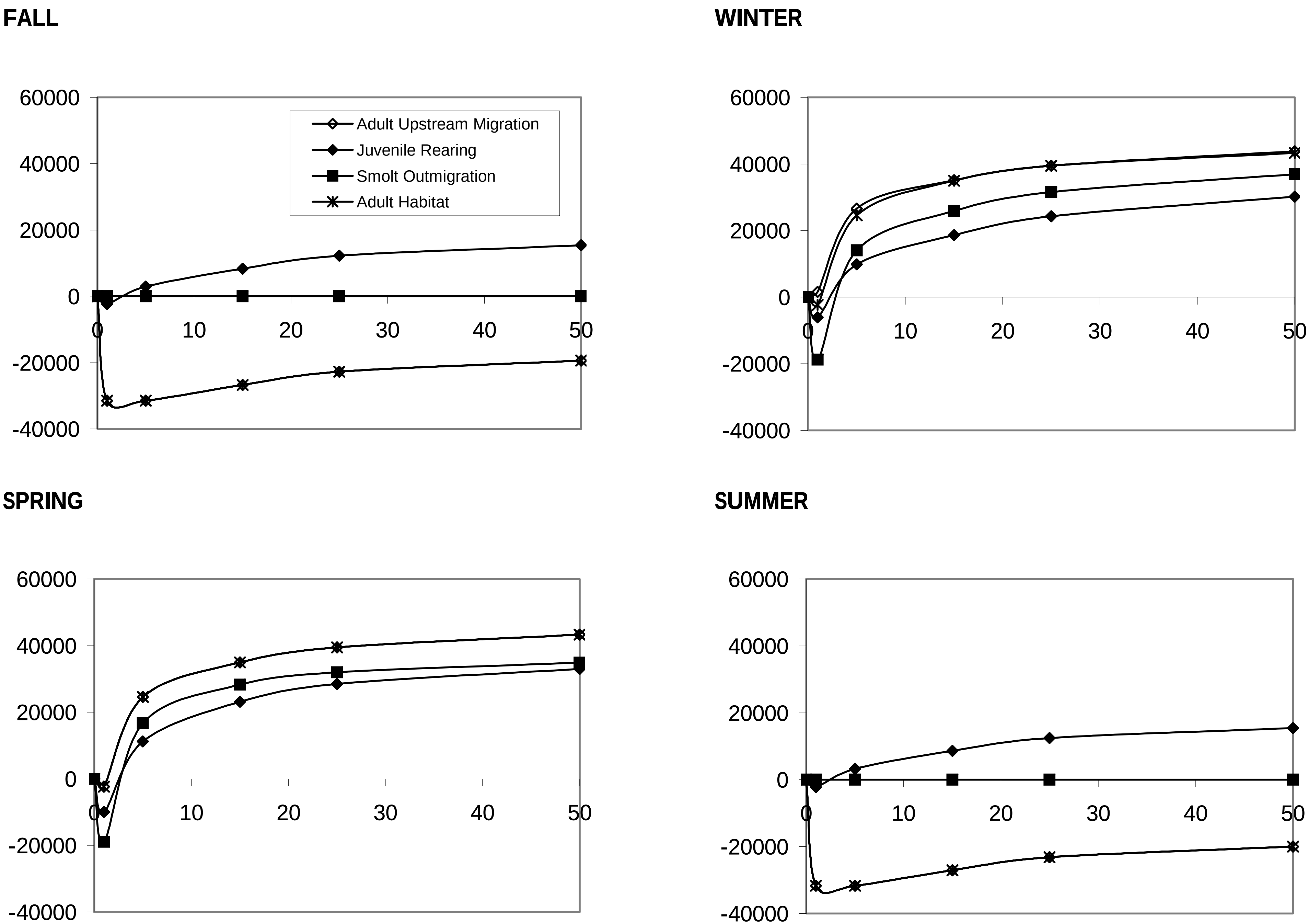


Figure I-62. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site RM 43.7R.

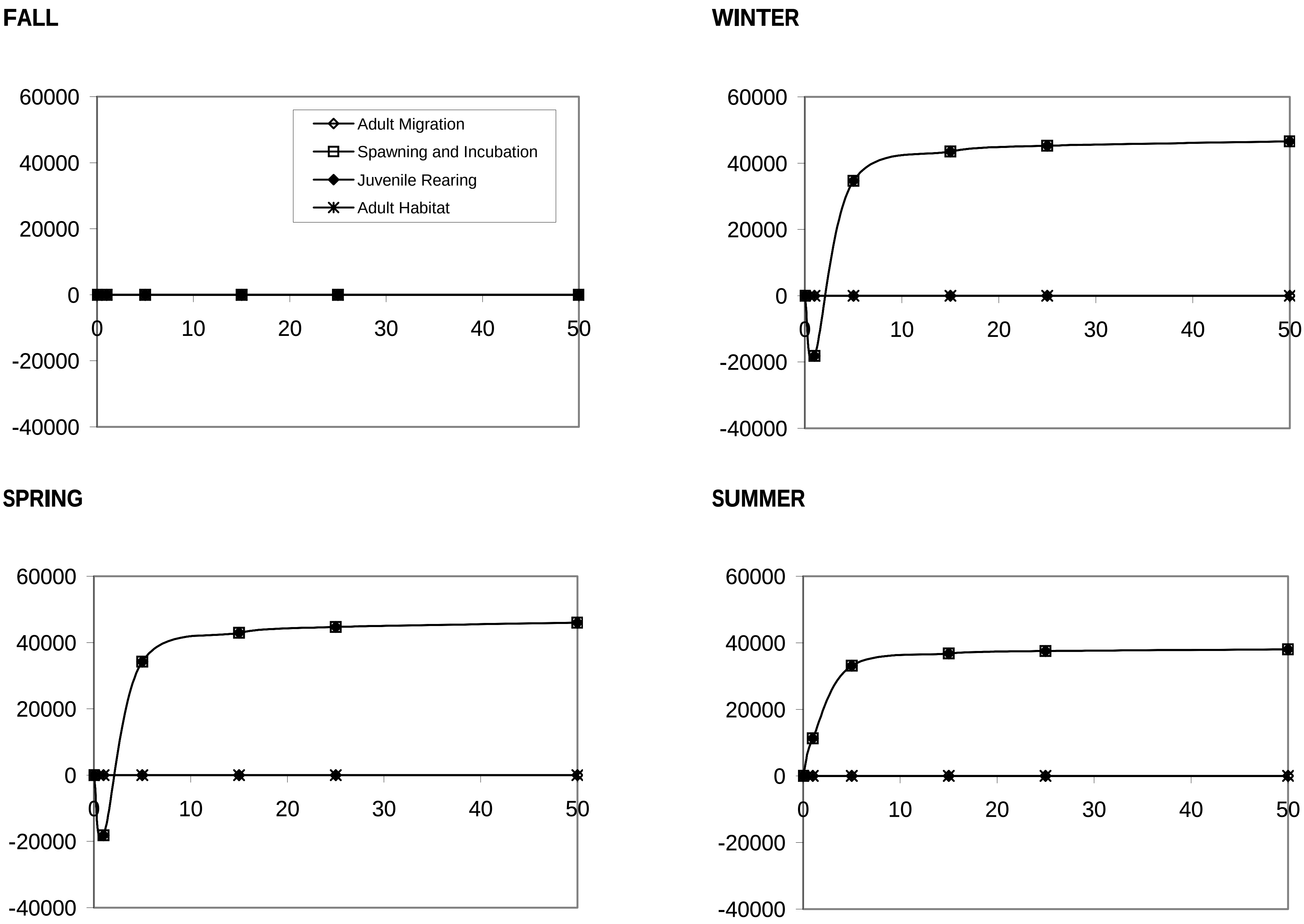


Figure I-63. SAM results showing wetted-area weighted relative response (square feet) for Delta smelt at Site RM 43.7R.

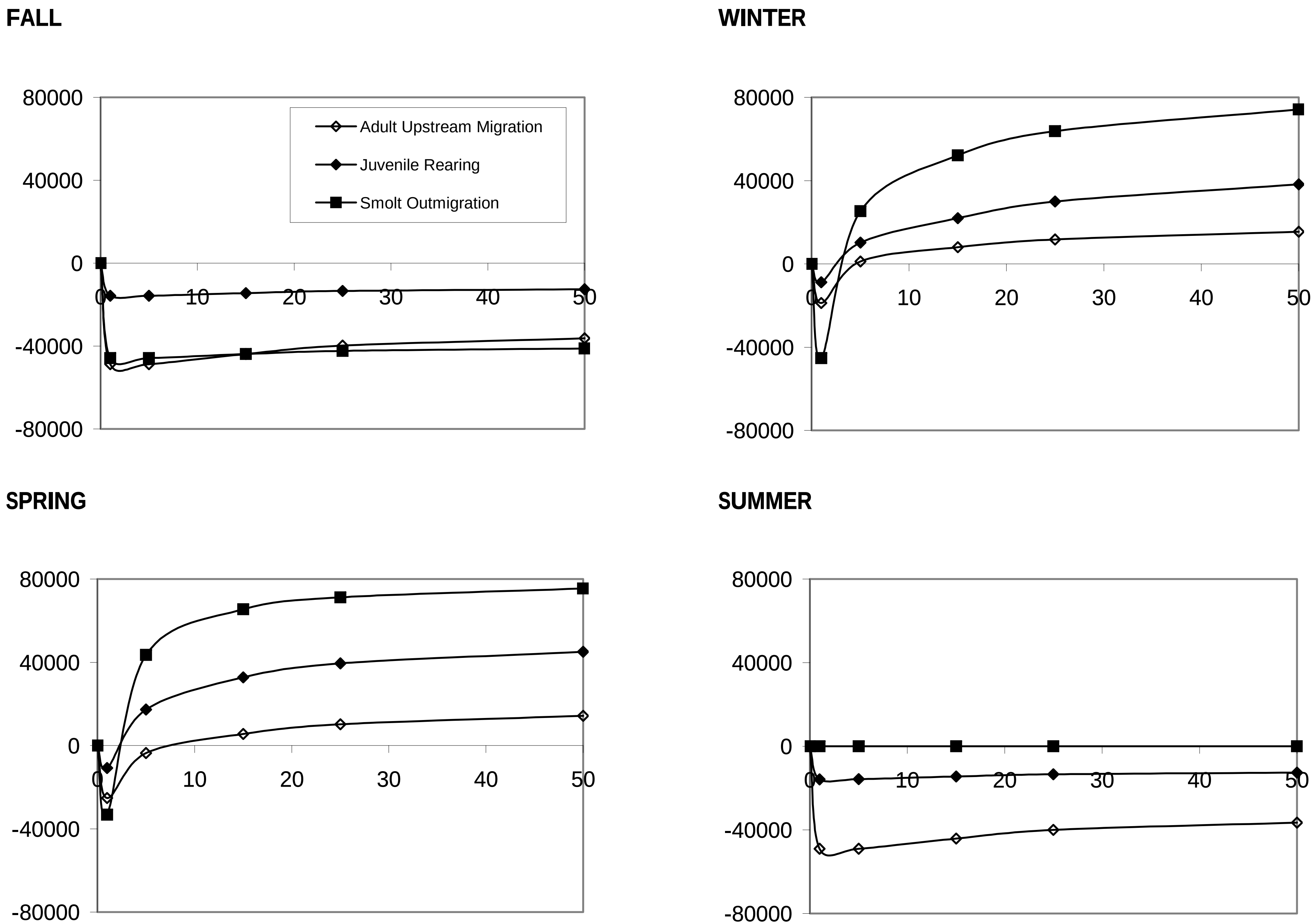


Figure I-64. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site RM 44.7R.

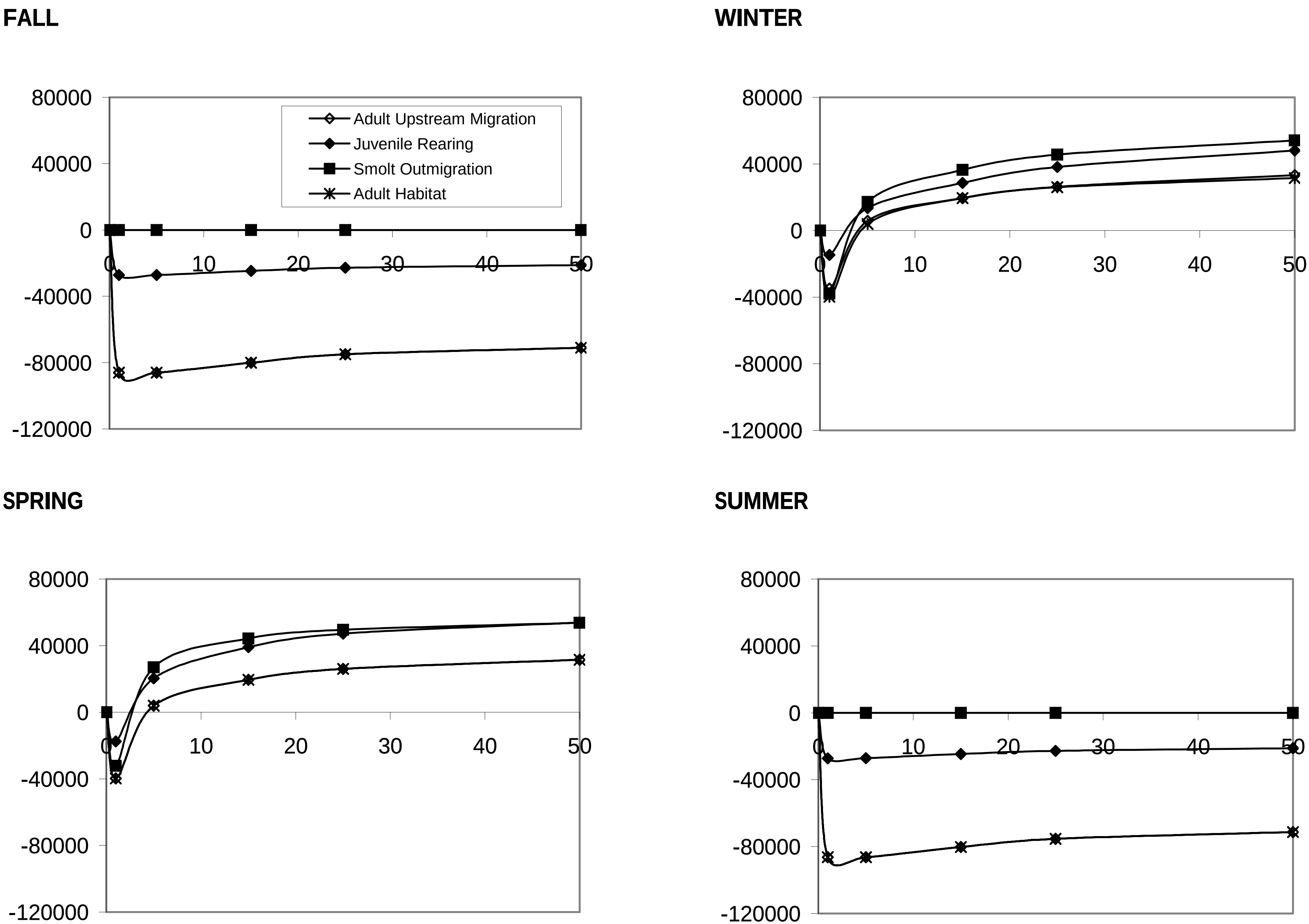


Figure I-65. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site RM 44.7R.

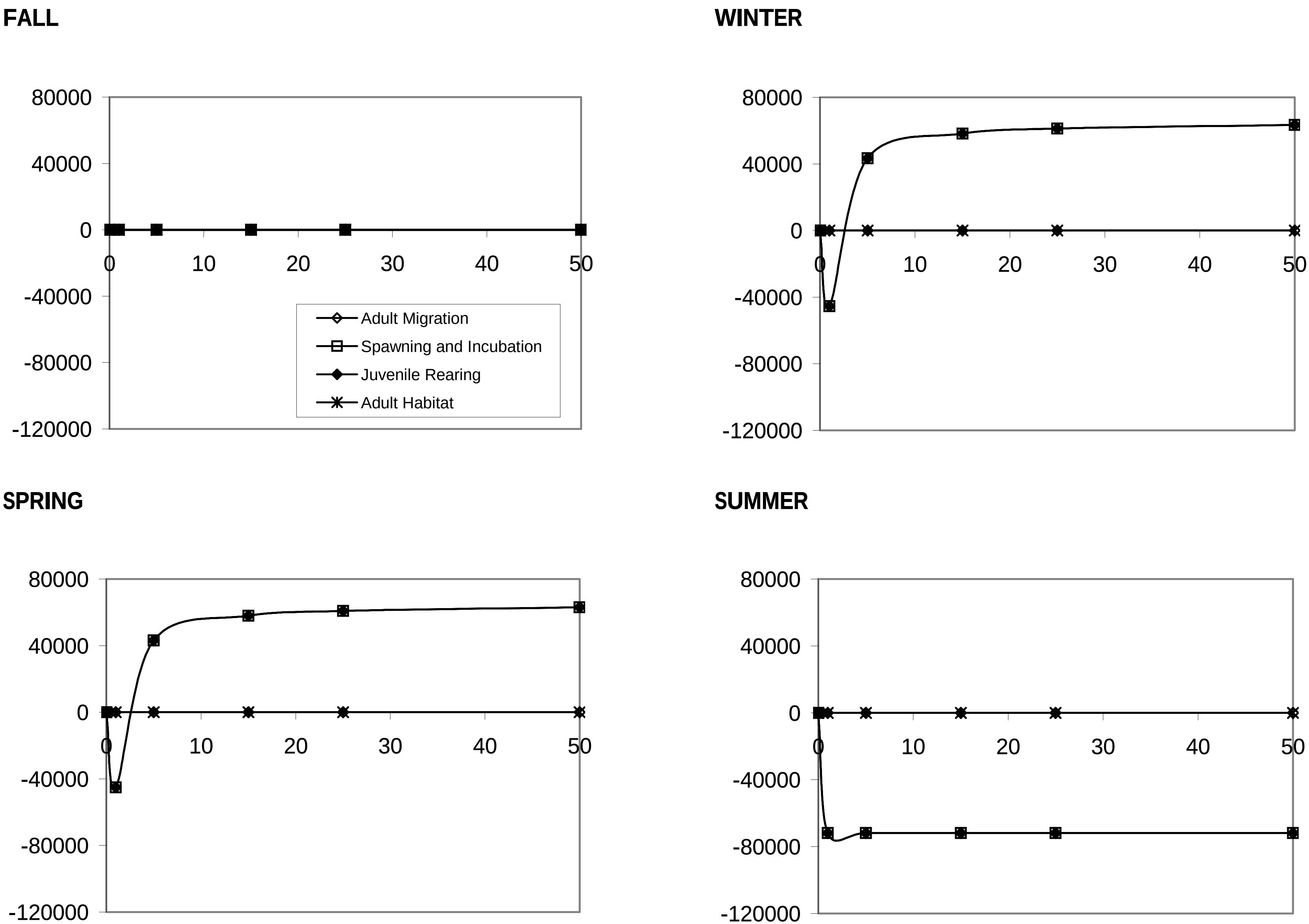


Figure I-66. SAM results showing wetted-area weighted relative response (square feet) for Delta smelt at Site RM 44.7R.

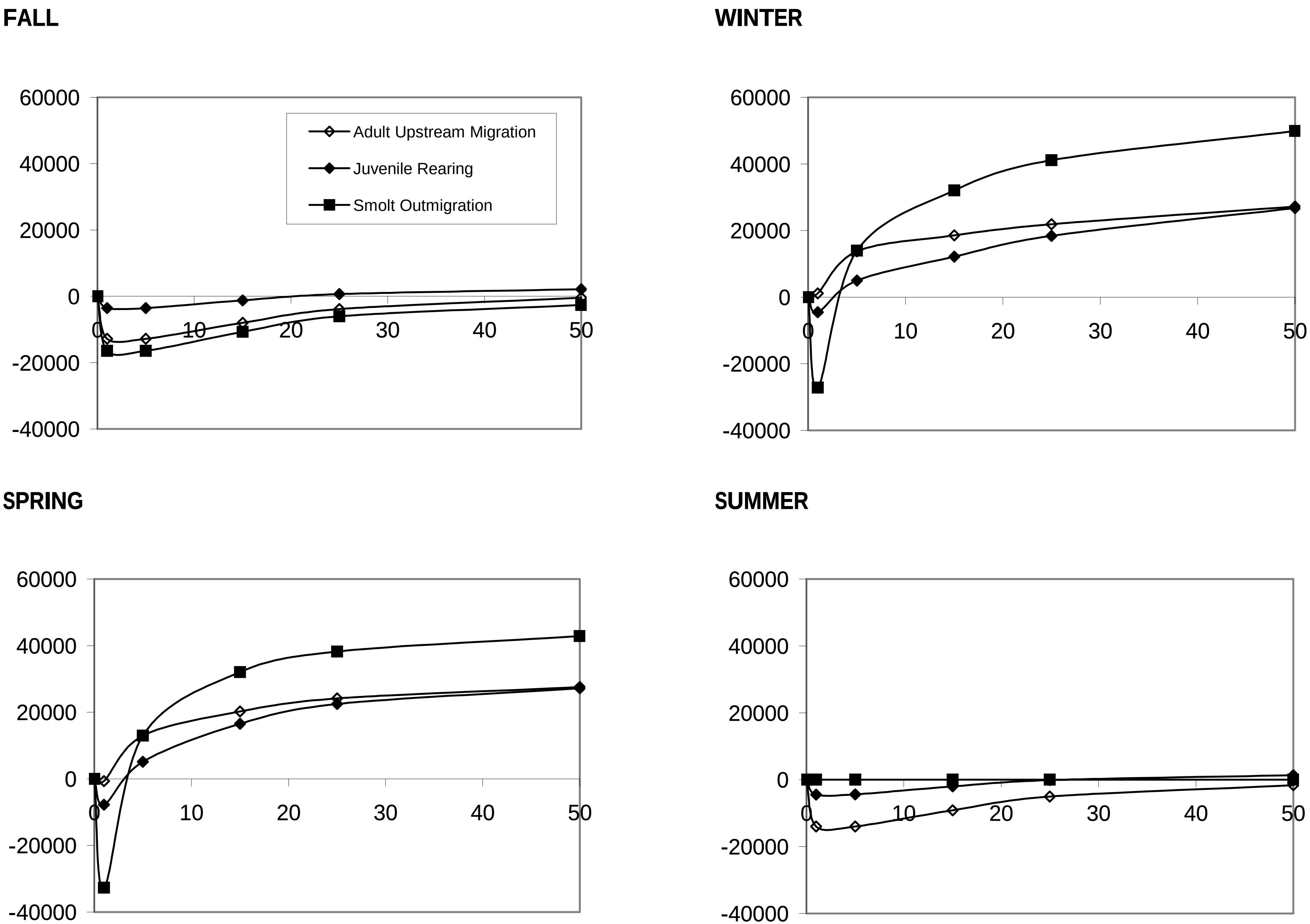


Figure I-67. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site RM 47.0L.

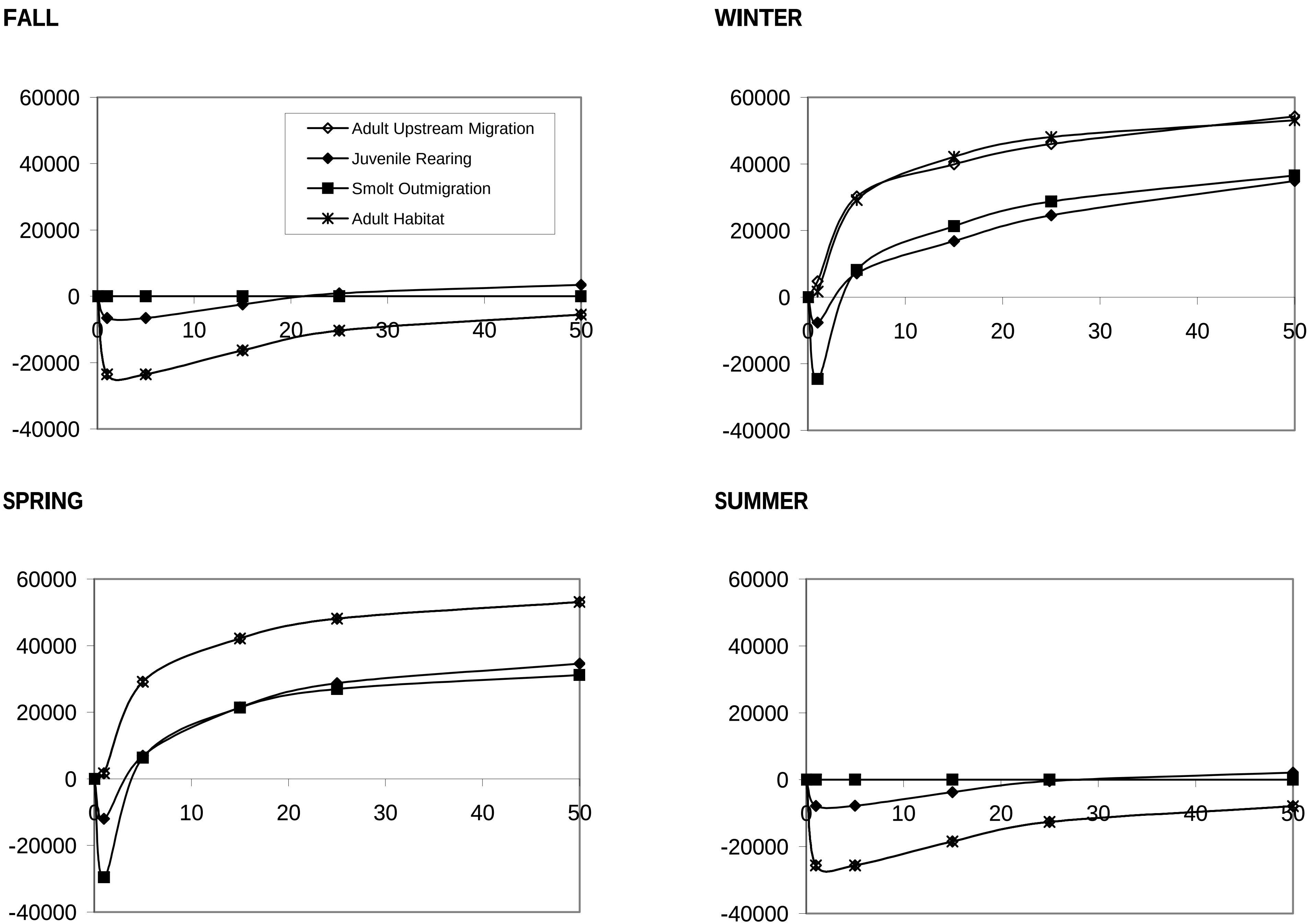


Figure I-68. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site RM 47.0L.

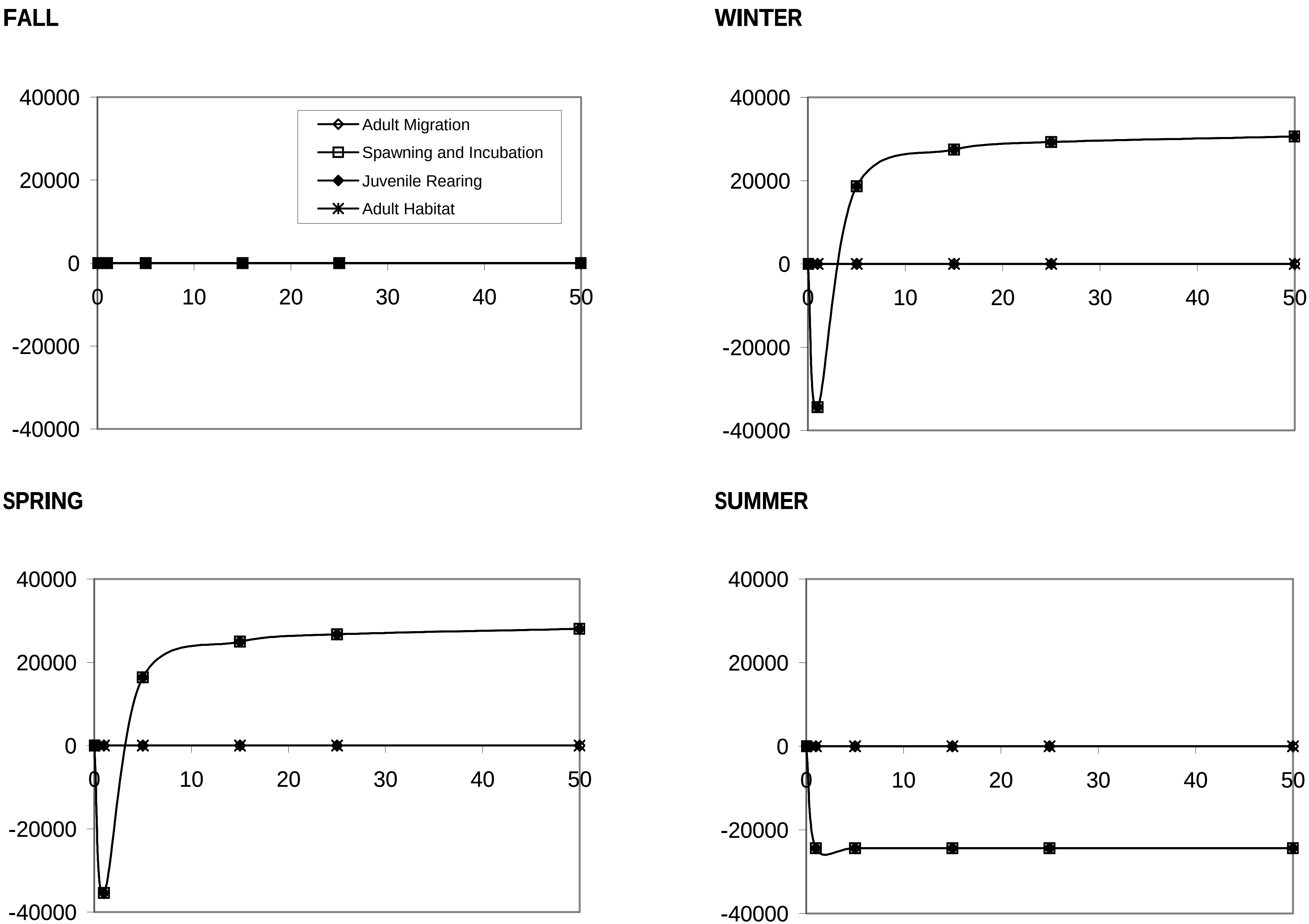


Figure I-69. SAM results showing wetted-area weighted relative response (square feet) for Delta smelt at Site RM 47.0L.

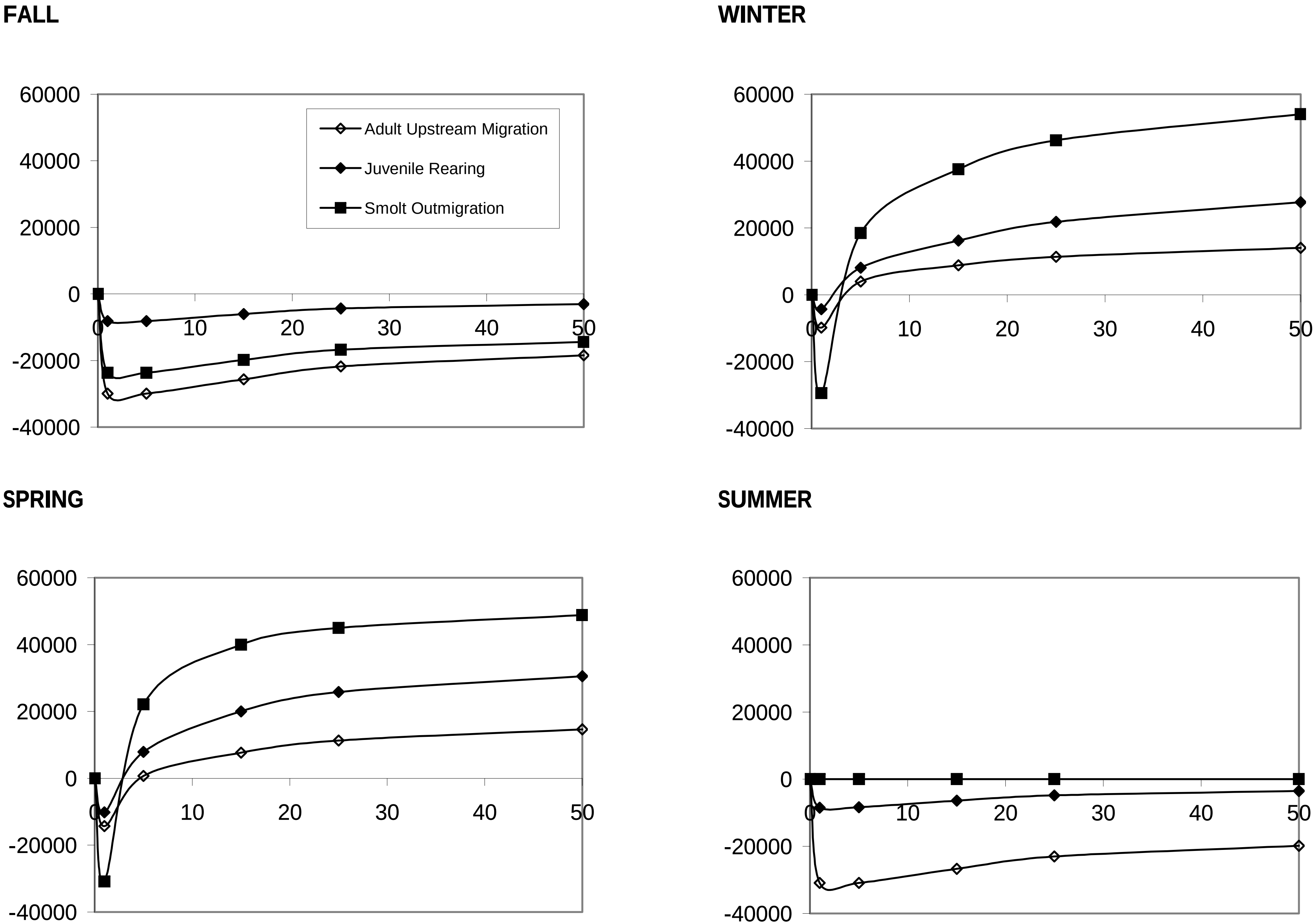


Figure I-70. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site RM 47.9R.

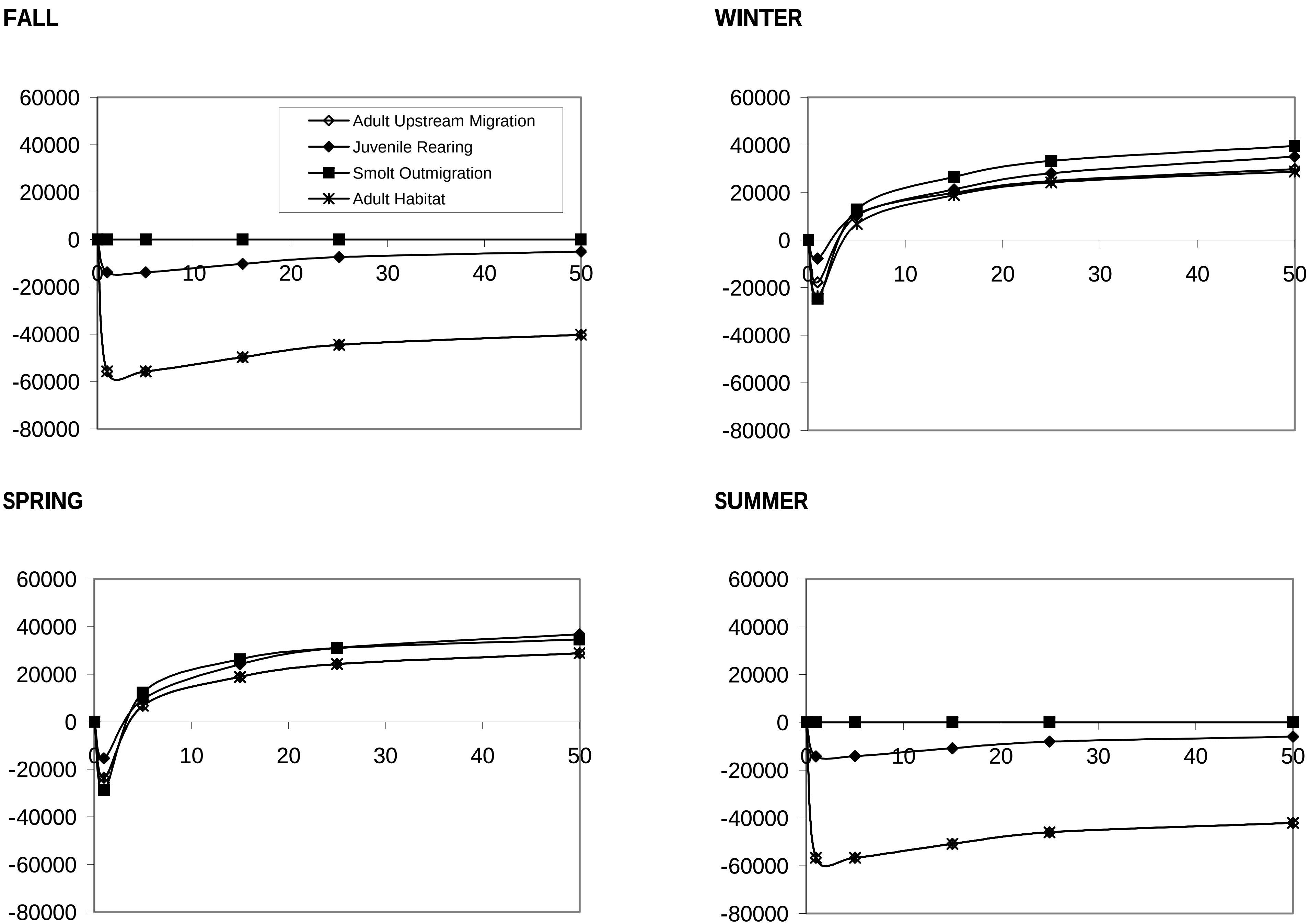


Figure I-71. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site RM 47.9R.

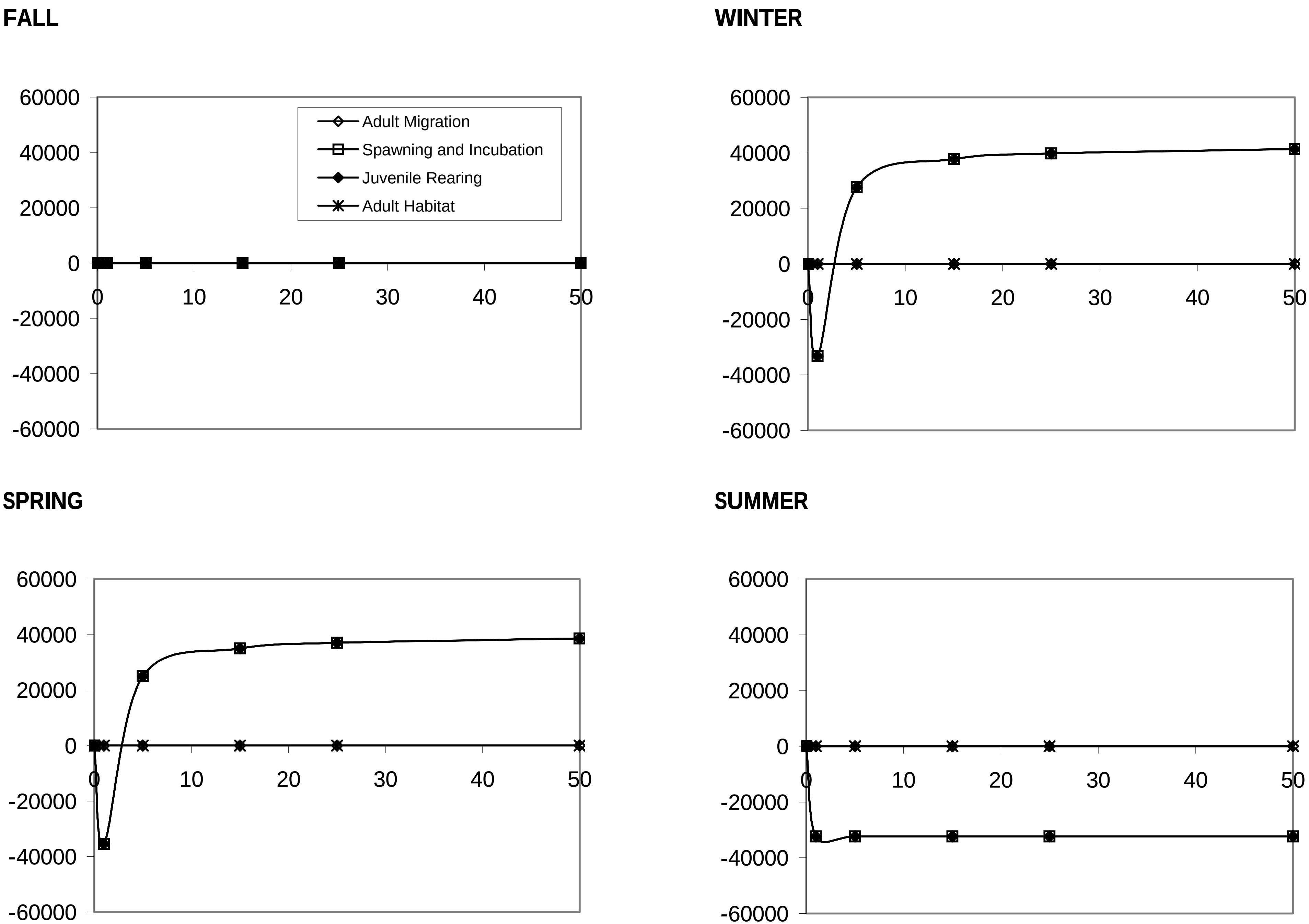


Figure I-72. SAM results showing wetted-area weighted relative response (square feet) for Delta smelt at Site RM 47.9R.

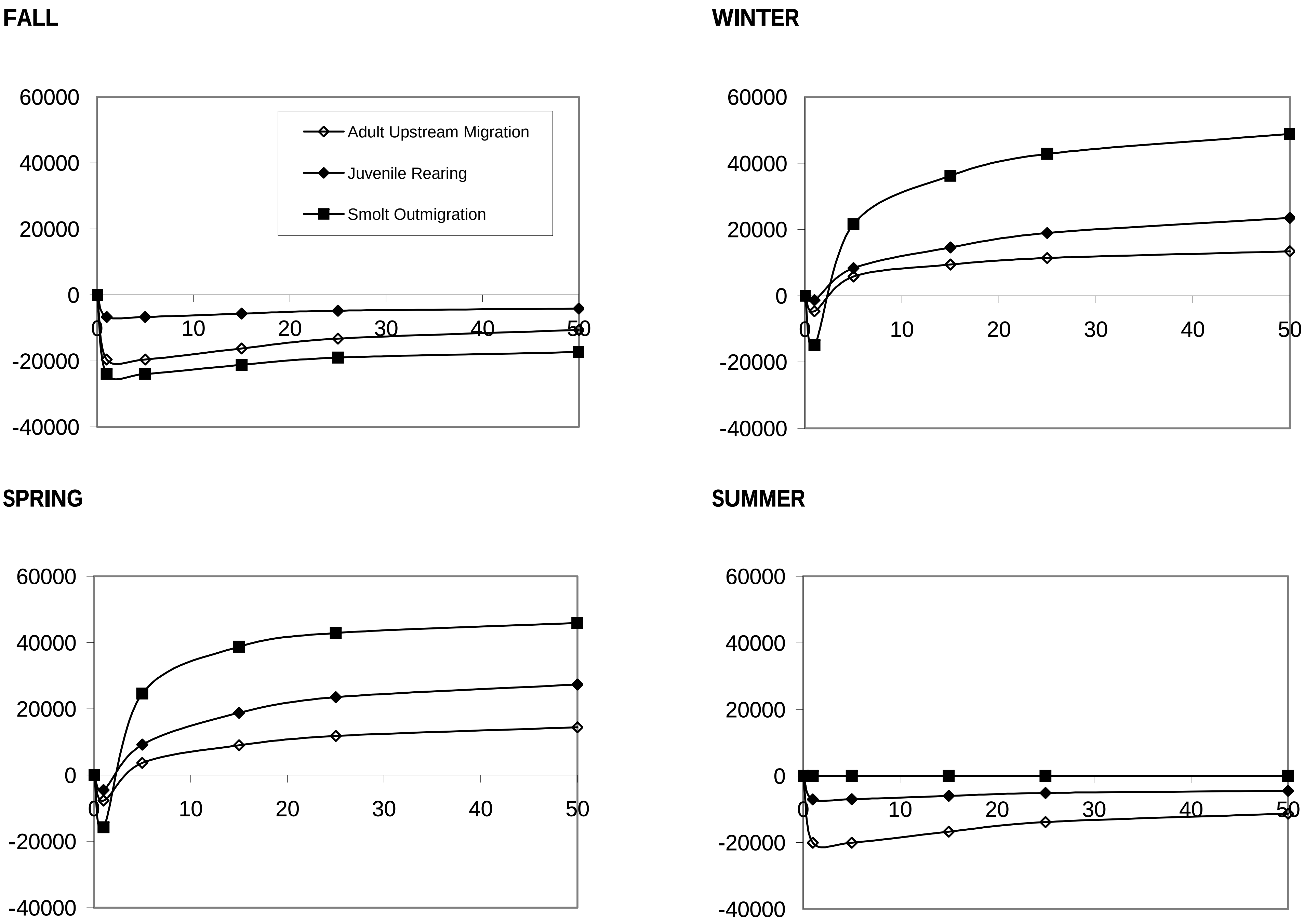


Figure I-73. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site RM 48.2R.

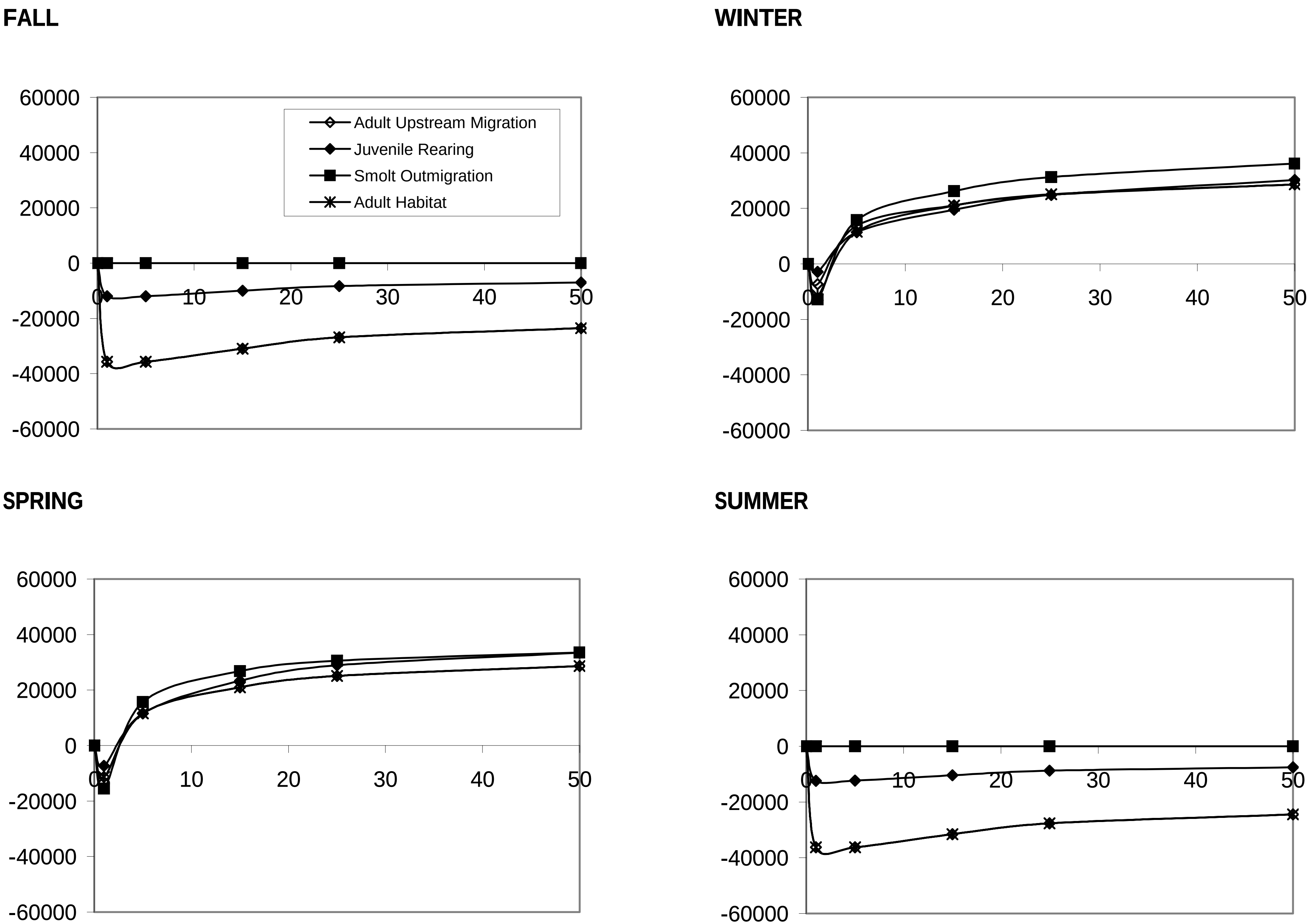


Figure I-74. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site RM 48.2R.

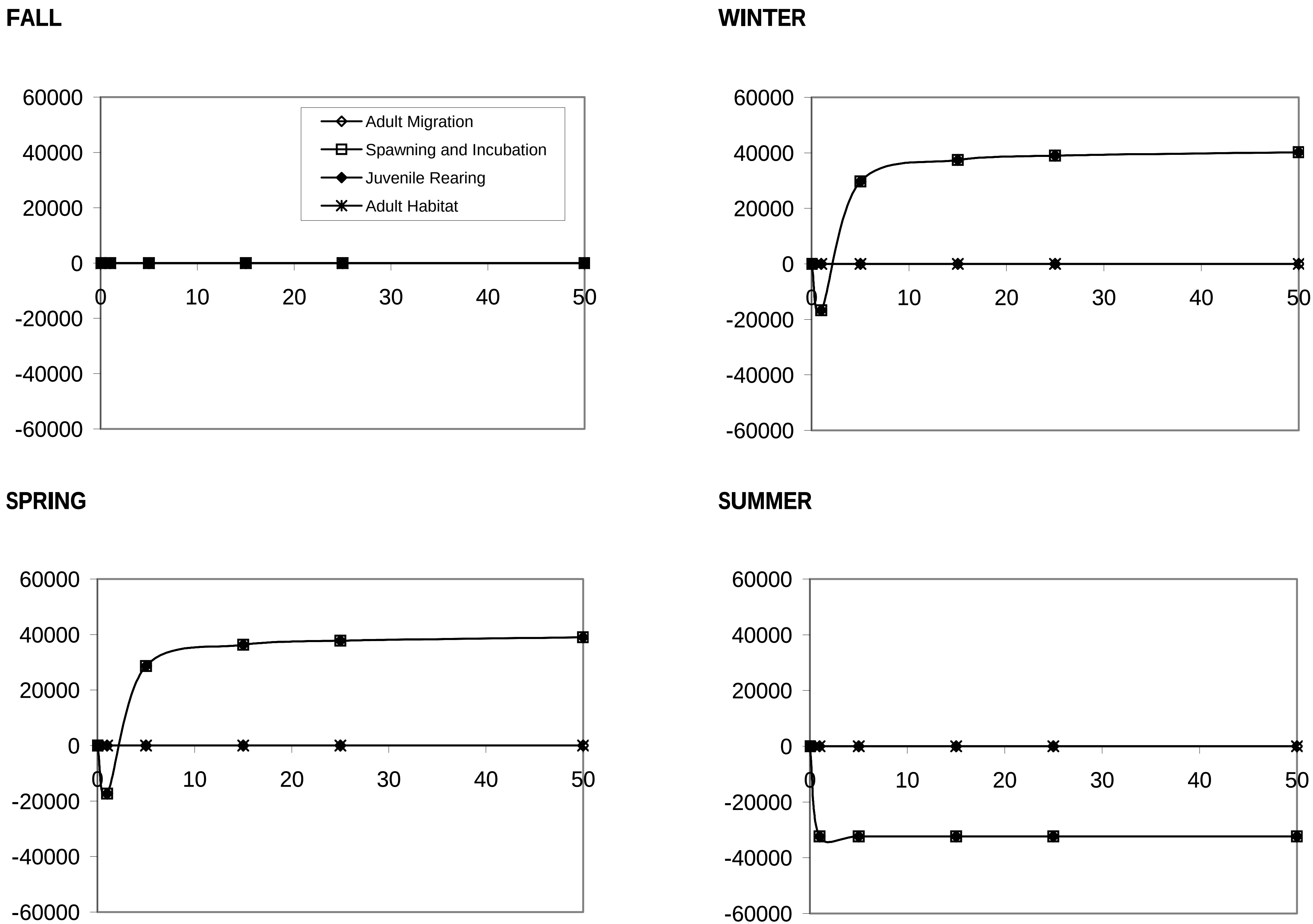
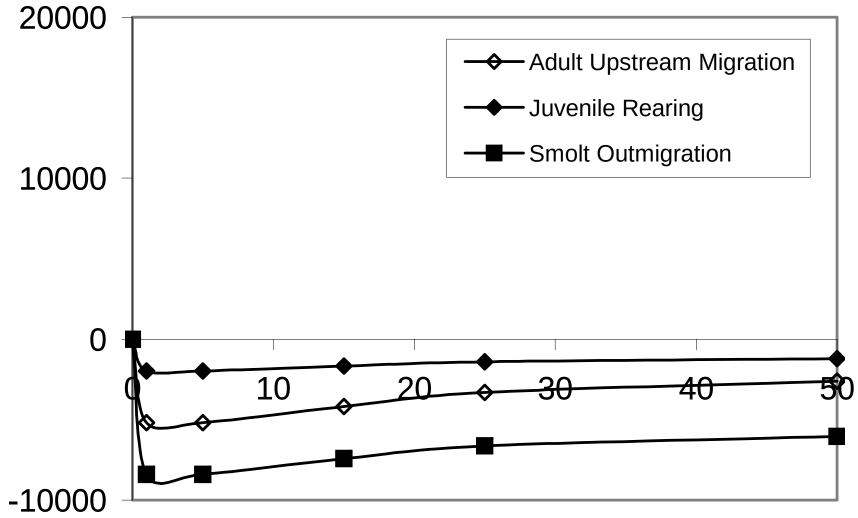
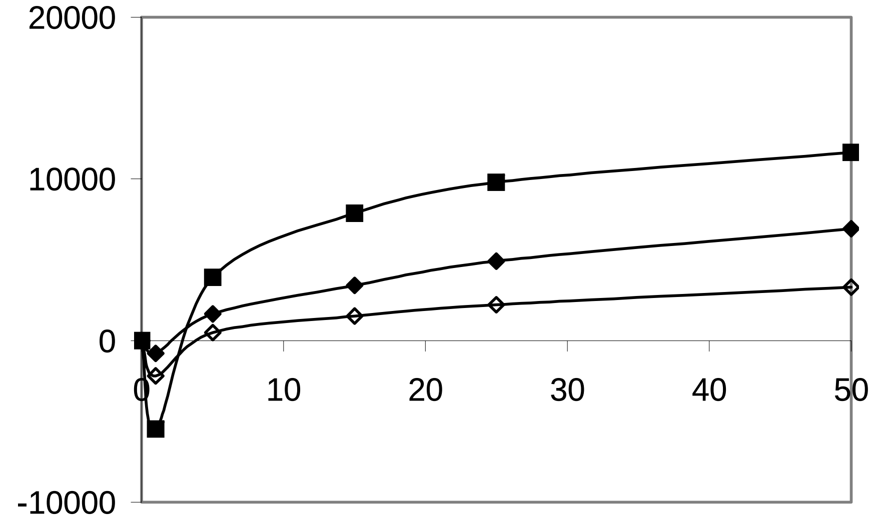


Figure I-75. SAM results showing wetted-area weighted relative response (square feet) for Delta smelt at Site RM 48.2R.

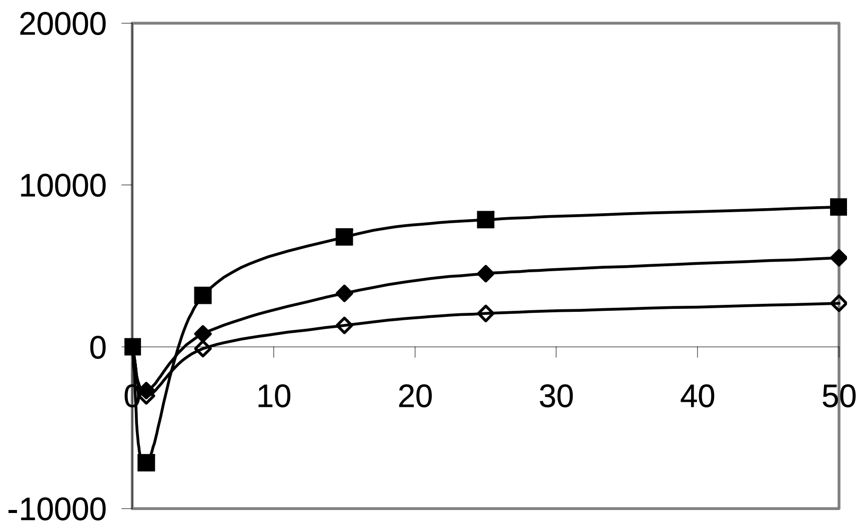
FALL



WINTER



SPRING



SUMMER

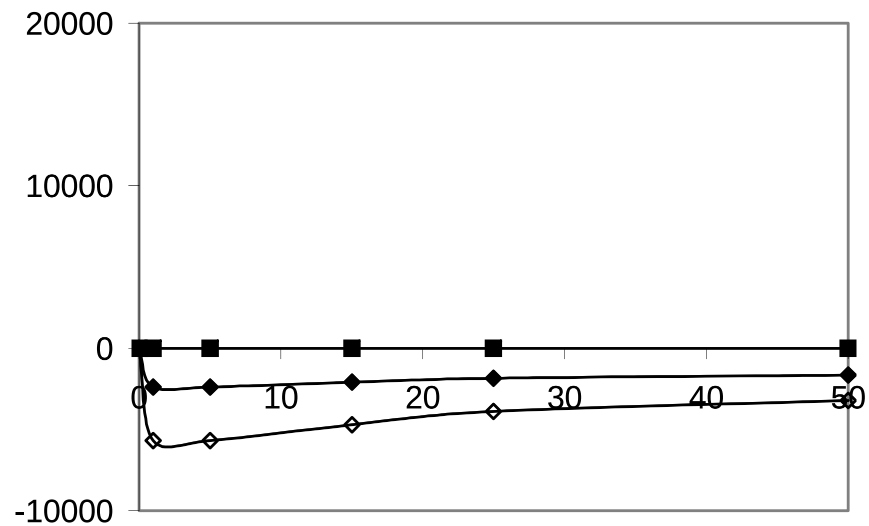


Figure I-76. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site RM 62.5R.

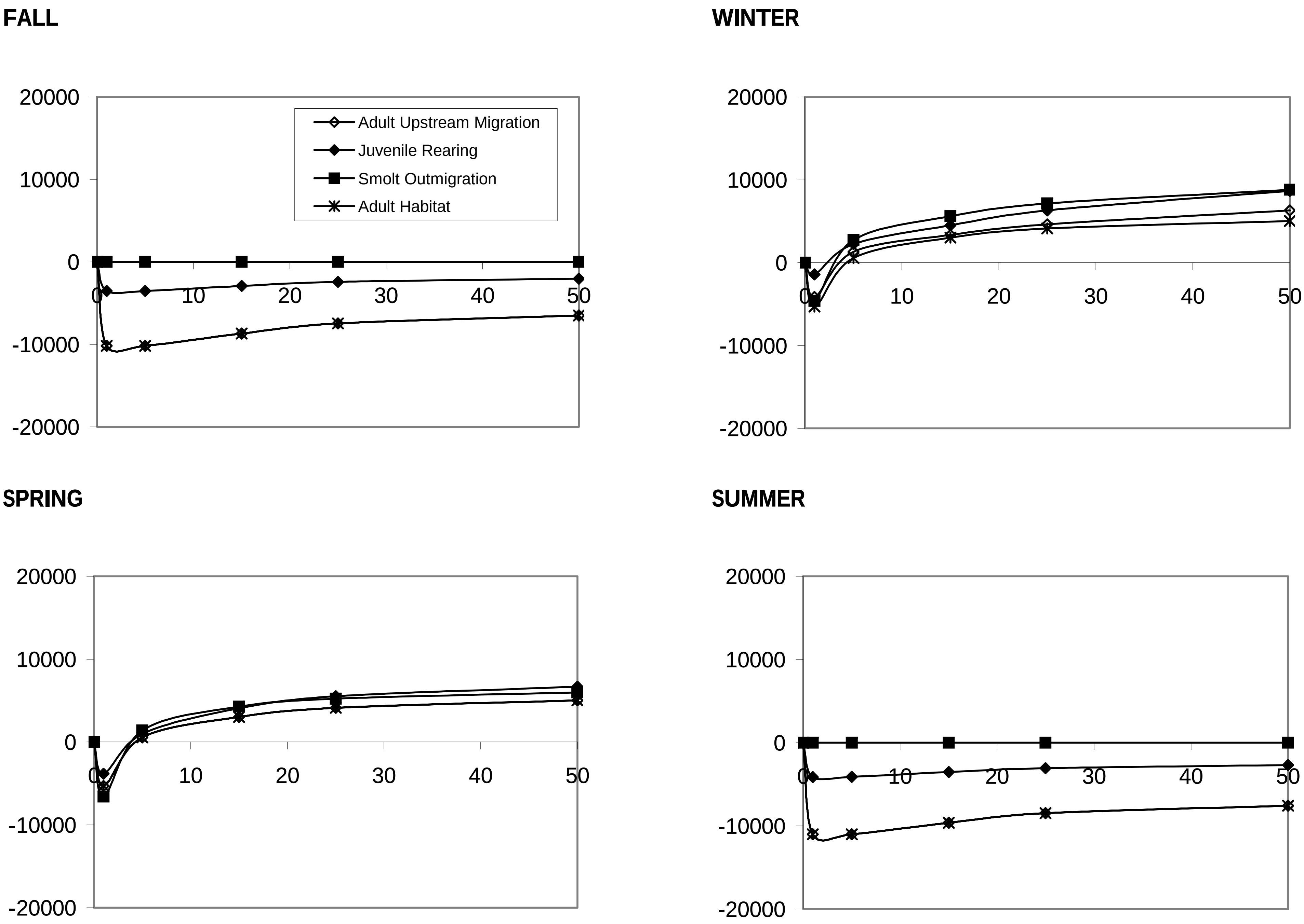


Figure I-77. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site RM 62.5R.

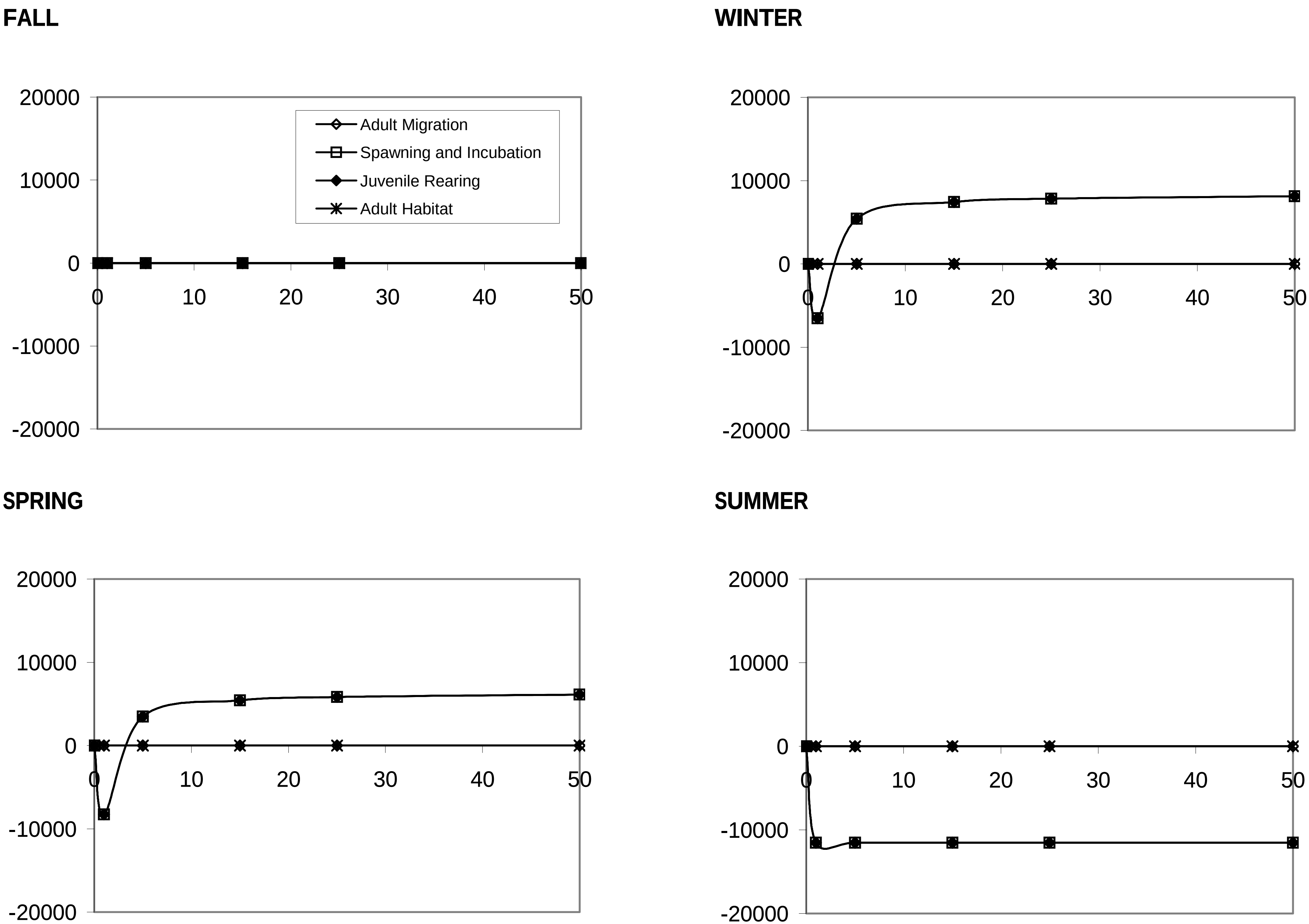


Figure I-78. SAM results showing wetted-area weighted relative response (square feet) for Delta smelt at Site RM 62.5R.

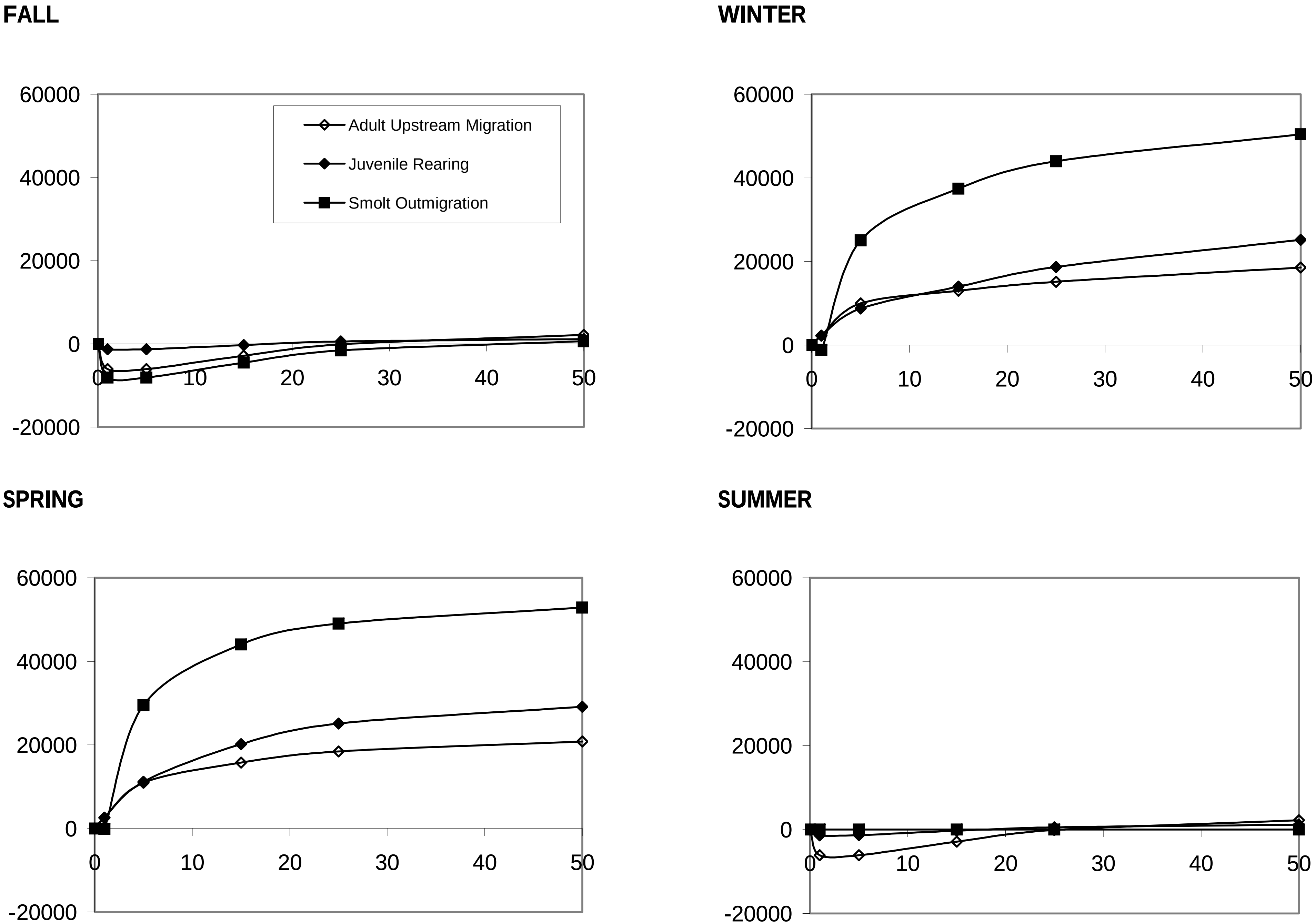


Figure I-79. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site RM 68.9L.

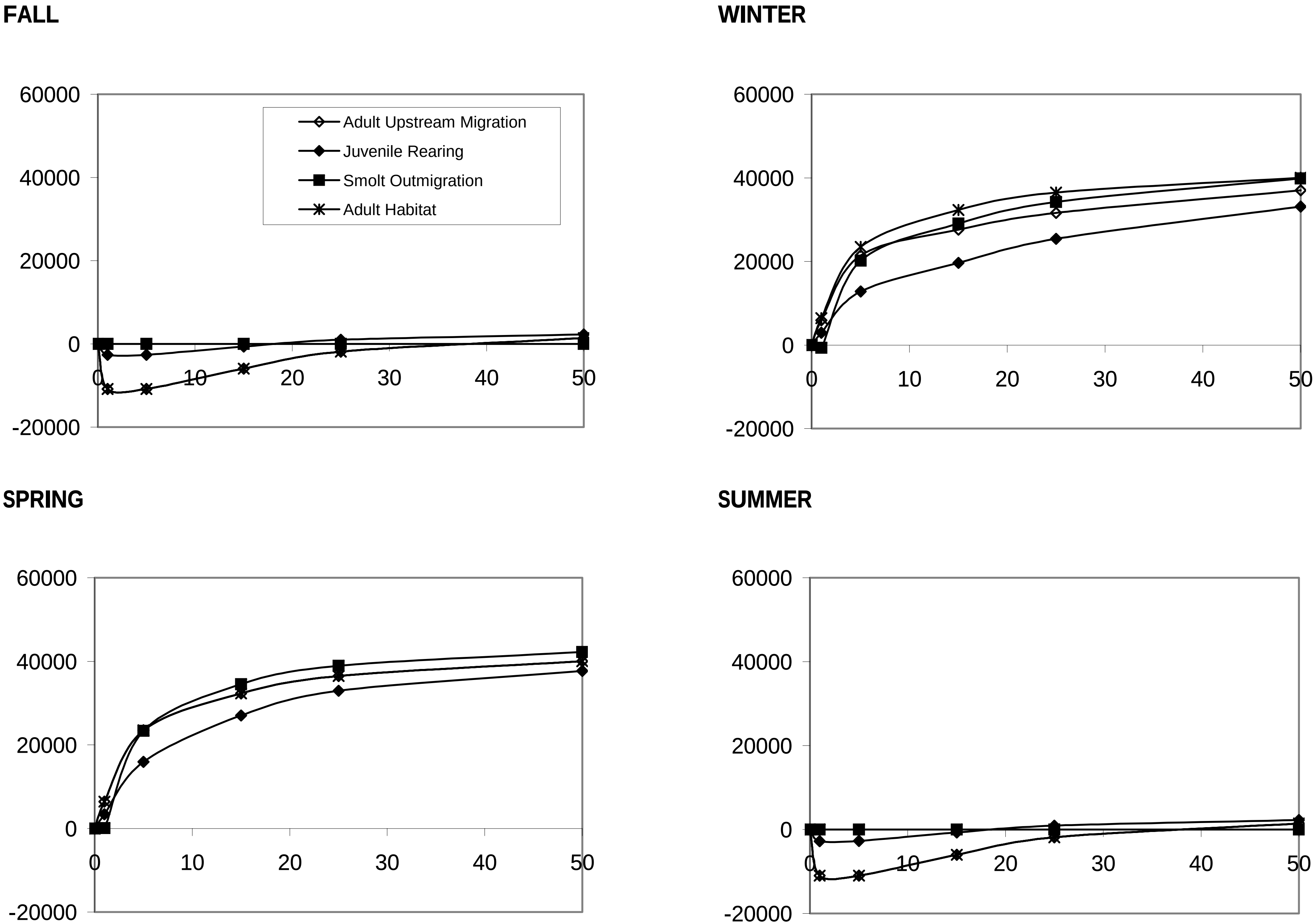


Figure I-80. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site RM 68.9L.

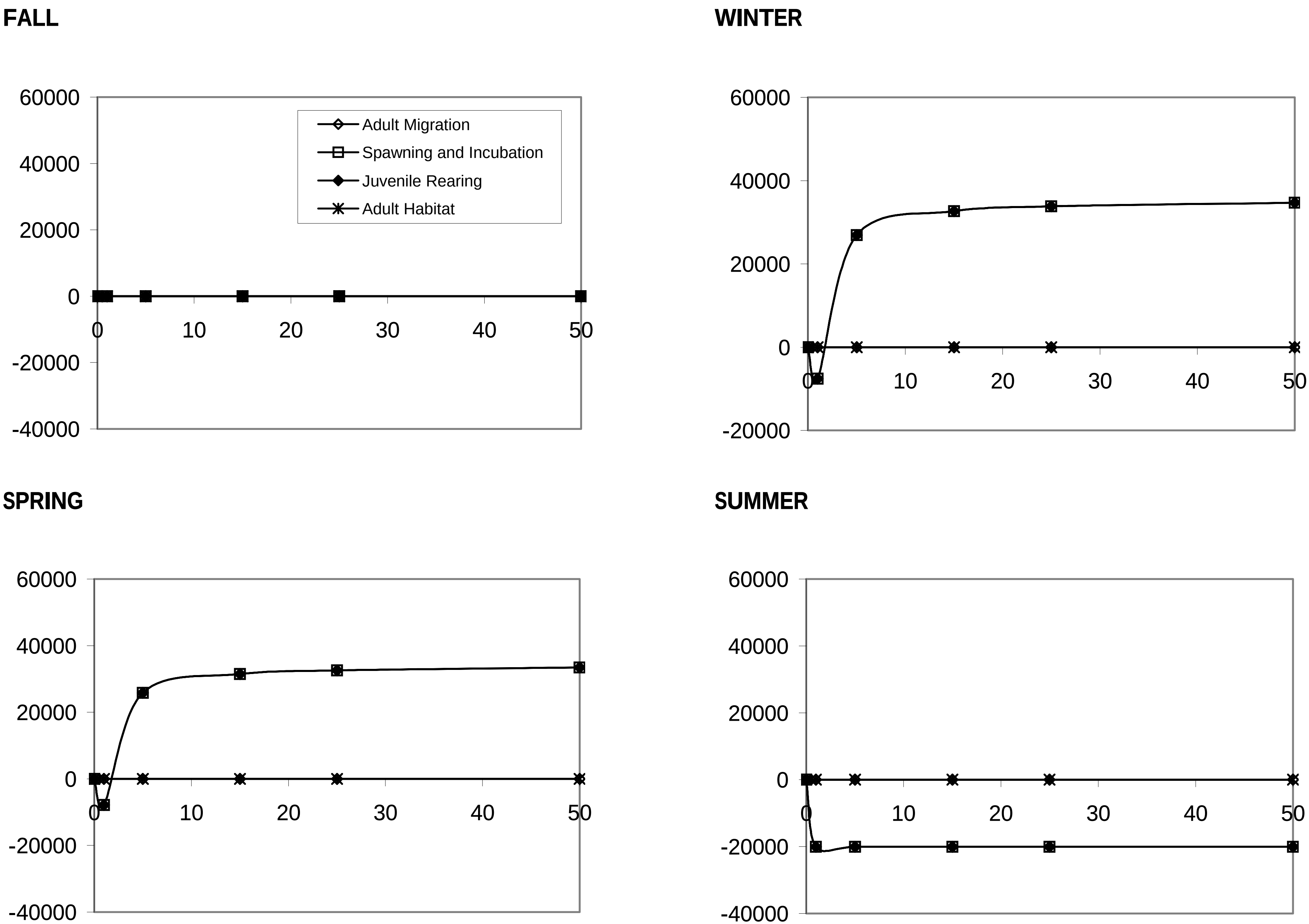


Figure I-81. SAM results showing wetted-area weighted relative response (square feet) for Delta smelt at Site RM 68.9L.

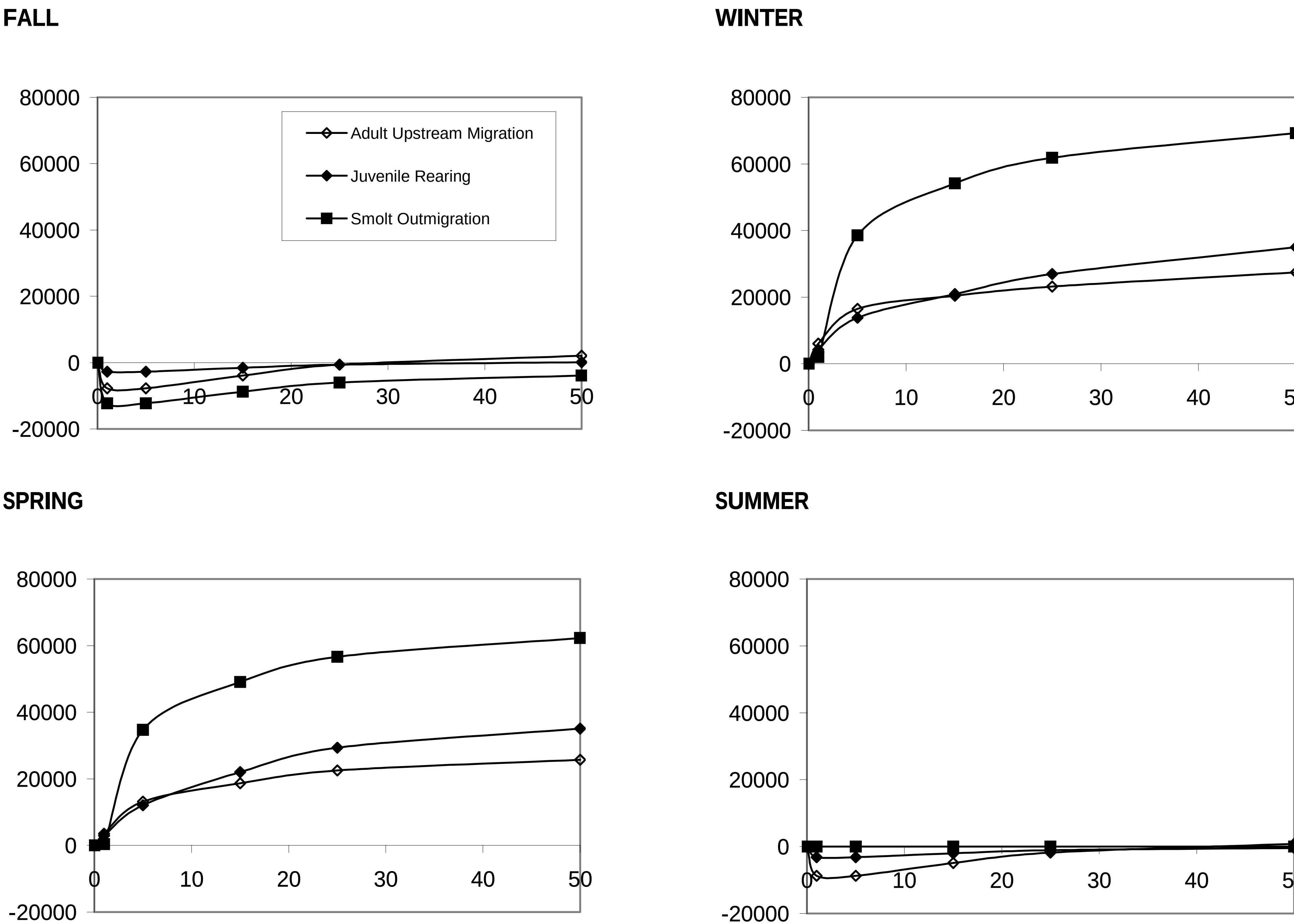


Figure I-82. SAM results showing wetted-area weighted relative response (square feet) for Chinook salmon (Winter-run shown) at Site RM 78.0L.

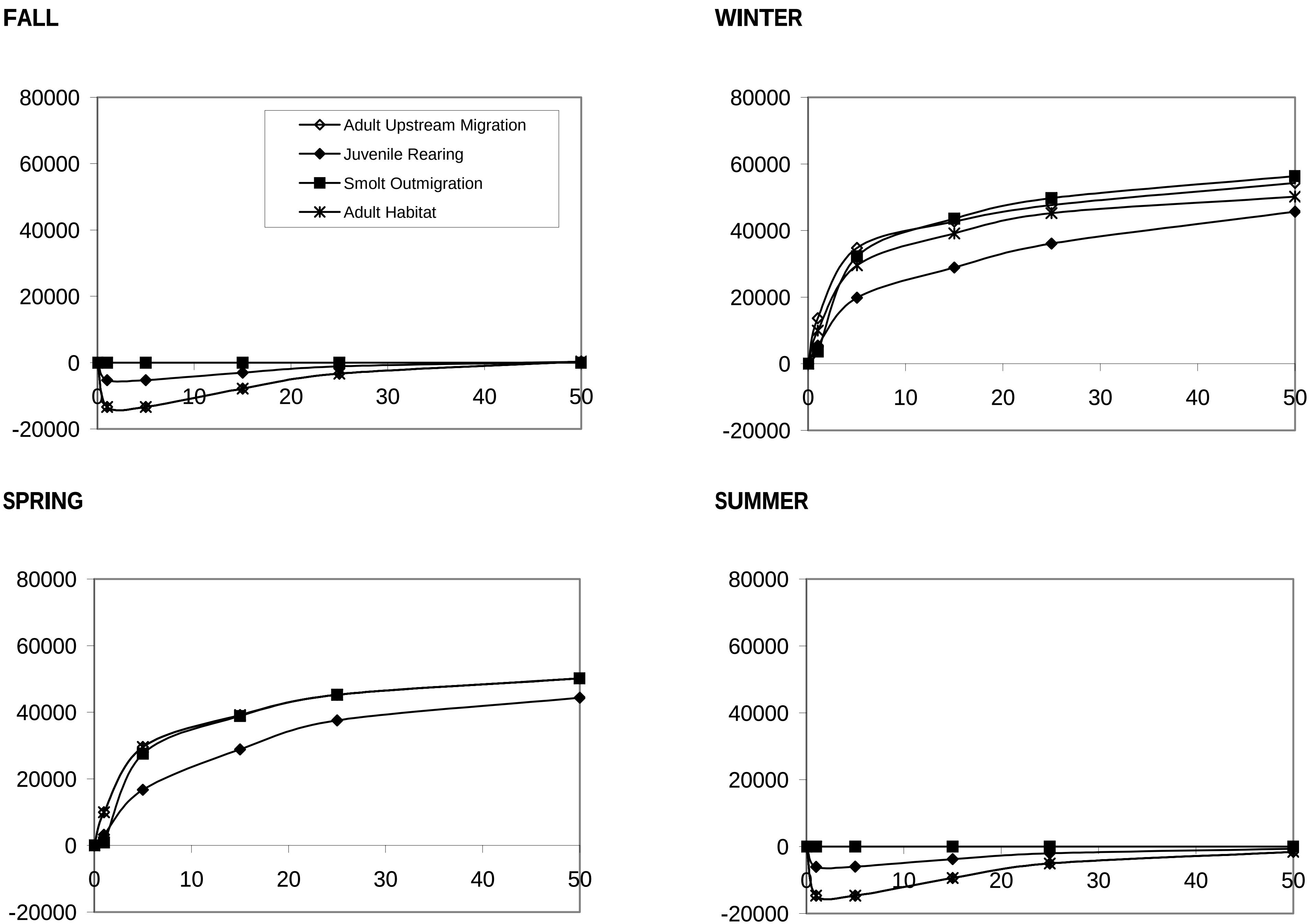


Figure I-83. SAM results showing wetted-area weighted relative response (square feet) for Central Valley steelhead at Site RM 78.0L.

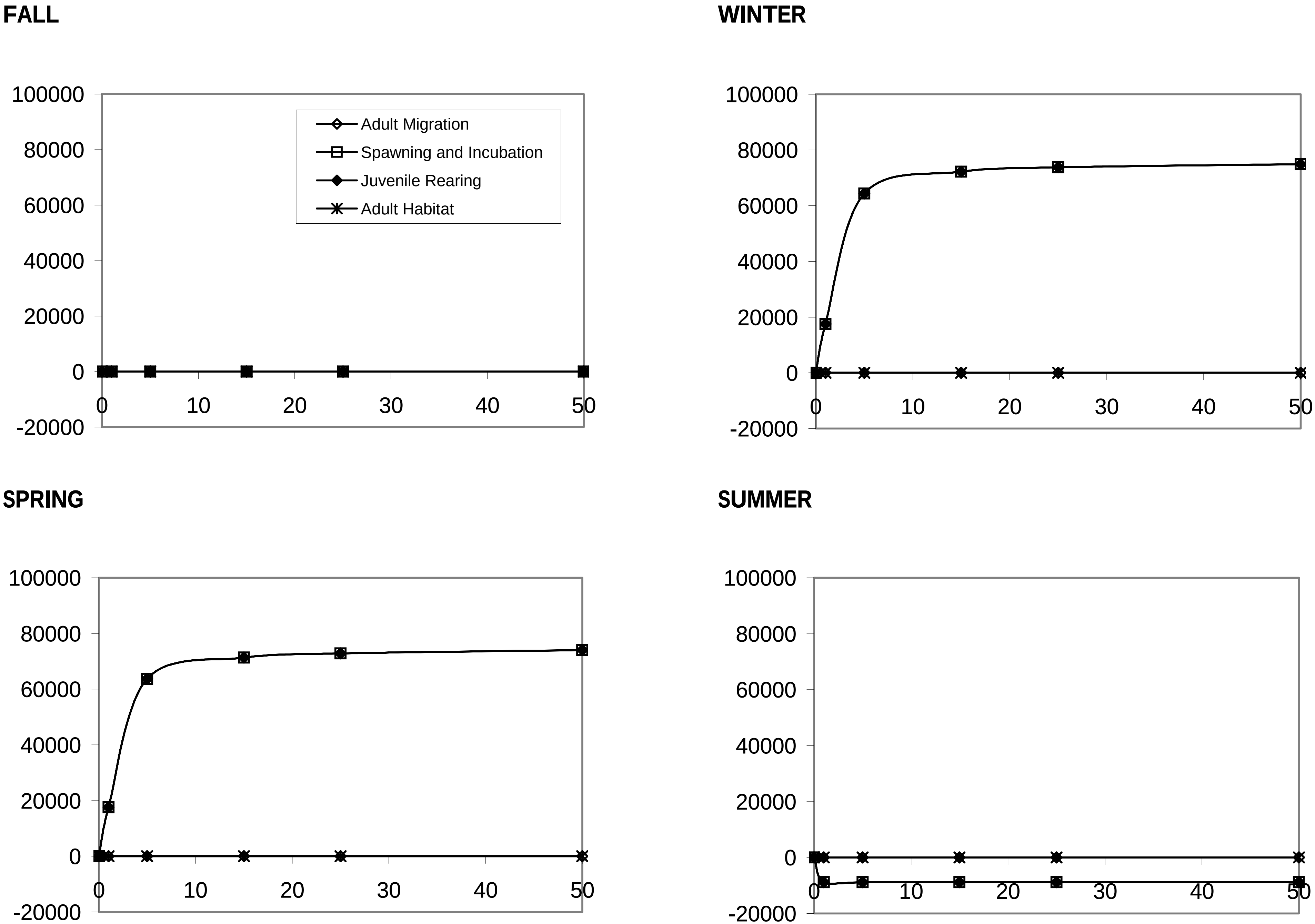


Figure I-84. SAM results showing wetted-area weighted relative response (square feet) for Delta smelt at Site RM 78.0L.

Appendix J

Response to Public Comment on Draft EA

Comment letter no.1 – Sutter Island Resident, Marilyn Bessey

To: Mike Dietl, Fishery Biologist, U. S. Army Corps of Engineers:

As a home/property owner on the Sacramento River, Sacramento County, in an area scheduled for inclusion in the Sacramento River Bank Protection Project, I am concerned that the planning documents do not appear to include any type of signage be posted to warn people of the hazards created by this project. Specifically, I feel signage should be posted to warn boaters that there may be submerged hazards along the banks of the river, extending 10 feet out into the river, which are not visible during high water time frames. Recreational uses of the river include boating, jet skiing , water skiing, camping and fishing. These are a few of the more popular activities enjoyed by our citizens.

I support the protection project and am appreciative of the increased level of safety from flooding it will provide my family and others living in the area. But, the potential for bodily injury and personal property damage to the river's recreational users (which includes my family-we are a boating/skiing family) is magnified by the upcoming construction. For this reason I request signage be posted as a part of the project to warn the population of these new safety hazards.

Thank you for your consideration.

Sincerely,

Marilyn R. Bessey
12210 River Road
Sutter Island
California, 95615

Sent to Mike Dietl via email on Tuesday, December 12, 2006 1:01 PM

Response to Comment Letter No. 1- Sutter Island Resident, Marilyn Bessey:

The Final EA includes providing signage and/or buoys at each of the critical sites to warn people of potential hazards during construction. .