

CASPIAN TERN PREDATION ON JUVENILE SALMONIDS IN THE COLUMBIA RIVER ESTUARY

1999 Interim Report

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Virtually every evolutionarily significant unit (ESU) of anadromous salmonid (*Oncorhynchus* spp.) in the Columbia Basin is currently or soon will be listed as threatened or endangered under the Endangered Species Act of 1973. We initiated a field study in 1997 to assess the impact of Caspian terns (*Sterna caspia*) and other piscivorous colonial waterbirds (cormorants, gulls) on survival of out-migrating juvenile salmonids in the Columbia River estuary and the lower Columbia River. We used a bioenergetics model to estimate the number of juvenile salmonids consumed by Caspian terns nesting on Rice Island, a dredged material disposal island in the estuary, during the 1997 and 1998 salmonid out-migration years. These estimates were 6 - 25 million smolts in 1997 and 7 - 15 million smolts in 1998, or 6 - 25% and 8 - 16% of the estimated number of salmonid smolts to reach the Columbia River estuary in 1997 and 1998, respectively. This magnitude of Caspian tern predation on juvenile salmonids in the Columbia River estuary has caused concern among regional fish managers. Here we present preliminary results from a pilot study to relocate a portion of the Rice Island tern colony to East Sand Island in order to test the hypothesis that terns nesting on East Sand Island would be less reliant on juvenile salmonids as a food source. We predicted that there would be more alternative prey available to terns nesting on East Sand Island (river mile 5) because of its proximity to marine habitats compared to Rice Island (river mile 21).

Our objectives in 1999, the third year of our study, were to compare and contrast the breeding colony size, diet composition, and productivity of Caspian terns nesting on Rice and East Sand islands. Specifically, we attempted to (1) monitor the size and productivity of the Caspian tern population in the Columbia River estuary, (2) determine the proportion of tern diets that consisted of juvenile salmonids, (3) estimate the number of juvenile salmonids consumed by Caspian terns nesting in the estuary, (4) determine habitat use and foraging distribution of Caspian terns nesting in the Columbia River estuary, and (5) test the efficacy of methods to relocate Rice Island terns to East Sand Island.

Prior to the arrival of terns at the Rice Island colony in 1999, an effort was made to reduce the area of suitable nesting habitat on the colony site. A core area on the Rice Island colony (0.65 hectares or 1.6 acres) was left unaltered and terns attempting to nest there were not disturbed at any time during the 1999 breeding season. Winter wheat was planted in late February on remainder of the Rice Island colony area, as well as in all other bare sand habitat that had not been previously used for tern nesting on Rice and other upper estuary islands (i.e., Miller Sands Spit and Pillar Rock Sands). After it was determined that the wheat would not be fully established by the time terns initiated nesting (due to a cold and wet spring that inhibited plant growth), silt fencing was erected on the portion of the colony area on Rice Island that was planted with wheat. To prevent nesting in off-colony areas, limited hazing of birds (i.e., eagle decoys and human harassment) was used prior to egg-laying. These efforts were successful in reducing the area used by nesting terns from 1.9 ha (4.6 acres) in 1998 to 1.0 ha (2.4 acres) in 1999. In 1999, nesting Caspian terns filled the 0.65-ha core area of habitat, and also nested on two new sites just outside the silt fencing, totaling about 0.32 ha (0.8 acres). A photo census of the Rice Island Caspian tern colony in 1999 indicated that the colony included about 8,096 nesting pairs, or roughly the same number of terns that nested on the colony the previous year (7,948 pairs). Terns compensated for the reduction in nesting habitat on Rice Island by nesting at higher densities (0.83 nests/m² in 1999 vs. 0.43 nests/m² in 1998).

After restoration of about 3 hectares (7.4 acres) of bare-sand nesting habitat on East Sand Island, 380 tern decoys and four audio playback systems were used to attract terns and encourage them to nest on the new site. In addition, we employed limited gull removal as a method to enhance prospects for successful restoration of a tern colony on East Sand Island. About 1,400 pairs of Caspian terns nested at the new colony site on East Sand Island. The East Sand Island tern colony occupied 0.3 hectares (0.74 acres) of the available habitat, and the nesting density was about 0.5 nests/m².

In 1999, the diet of Rice Island Caspian terns was similar to 1997 and 1998, and consisted primarily of juvenile salmonids (75% of prey items), mostly chinook, coho, and steelhead smolts. As in 1997 and 1998, juvenile salmonids were most prevalent in tern diets in April and May. Preliminary estimates of the numbers of juvenile salmonids consumed by Rice Island Caspian terns during the 1999 breeding season are similar to 1998, or about 7 to 15 million smolts. In contrast, the diet of terns nesting at East Sand Island was 44% salmonids, or 41% fewer salmonids than were consumed by terns nesting on Rice Island. As predicted, fish with marine affinities (i.e., herring, anchovies, smelt, surf perch, sand lance) were more prevalent in the diet of terns nesting on East Sand Island compared to those nesting on Rice Island.

We used radio-telemetry to determine the foraging patterns and habitat use of adult terns breeding at both the East Sand Island and Rice Island colonies. Tail-mounted radio-transmitters were attached to 30 terns caught at the Rice Island colony and 22 terns caught at the East Sand Island colony. Radio-tagged terns were tracked during foraging trips from a fixed-wing aircraft and using fixed-location tracking stations within the estuary. During the brood-rearing period, Rice Island terns foraged significantly more in freshwater habitats higher in the estuary, where juvenile salmonids were apparently the primary prey available. Terns nesting on East Sand Island foraged primarily in marine areas, where alternative prey were apparently more abundant, as indicated by the diet composition.

Caspian tern nesting success on the Rice Island colony in 1999 was about 0.52 young raised per nesting attempt, similar to Rice Island productivity in 1998 (0.50 young raised per nesting attempt), but considerably lower than at other well-studied Caspian tern colonies along the Pacific Coast (average of 1.1 young raised per nesting attempt). By comparison, nesting success at East Sand Island was approximately 1.2 young raised per nesting attempt. The removal of 183 western/glaucous-winged gulls from the tern colony site by shooting was at least partly responsible for high tern nesting success at East Sand Island, compared to Rice Island.

These research results suggest that relocating the Caspian tern colony from Rice Island to East Sand Island is a feasible and effective management action for reducing tern predation on juvenile salmonids in the short-term. Our results also suggest that moving the tern colony to East Sand Island will not negatively impact the nesting productivity of the terns. The success of our attempt to restore a Caspian tern colony to East Sand Island is partly a reflection of the species' nesting ecology. Caspian terns prefer to nest on bare sand substrate, at a safe elevation above high tide, and on islands that are devoid of mammalian predators. These habitats are ephemeral, and can be created or destroyed during winter storm events. Consequently, Caspian terns are able to more easily adapt to changes in available nesting habitat than most other colonial seabirds. Longer-term management could include attracting portions of the current Caspian tern population in the Columbia River estuary to nest outside the estuary. Management action focusing on tern predation in the estuary may be an effective and efficient component of a comprehensive plan to restore salmonids to the Columbia River Basin.