US Army Corps of Engineers ®
Portland District

Final Environmental Assessment

CASPIAN TERN NESTING HABITAT MANAGEMENT
EAST SAND ISLAND
CLATSOP COUNTY, OREGON

MARCH, 2014

CHAPTER 1
INTRODUCTION

Overview

Since the late 1990's the U.S Army Corps of Engineers (Corps), Portland District has been researching, monitoring and managing Caspian terns, also referred to as "terns" on islands the Corps owns and/or uses to dispose of dredged material in the Columbia River Estuary. Caspian terns have a broad distribution in the world, and in the U.S.; the Western Metapopulation nesting in various locations from Alaska to southern California (Figure 1). They first nested on East Sand Island in the Columbia River Estuary in 1984 following deposition of fresh dredged material at the eastern tip of the island in 1983. By 1985, vegetation covered the East Sand Island nesting site making it unsuitable for nesting, and by 1986 the tern colony had shifted to Rice Island, a dredged material disposal site 16 miles upriver (Figure 2). In 1999 and 2000, the Corps socially attracted the terns, using decoys and playing pre-recorded callbacks, from Rice Island back to East Sand Island, which is owned and managed by the Corps. This relocation was done to decrease the numbers of juvenile salmon and steelhead consumed by the terns to meet the Corps' commitments with the National Oceanic and Atmospheric Administration's National Marine Fisheries Service, which are detailed in a Biological Opinion (NMFS 2008).

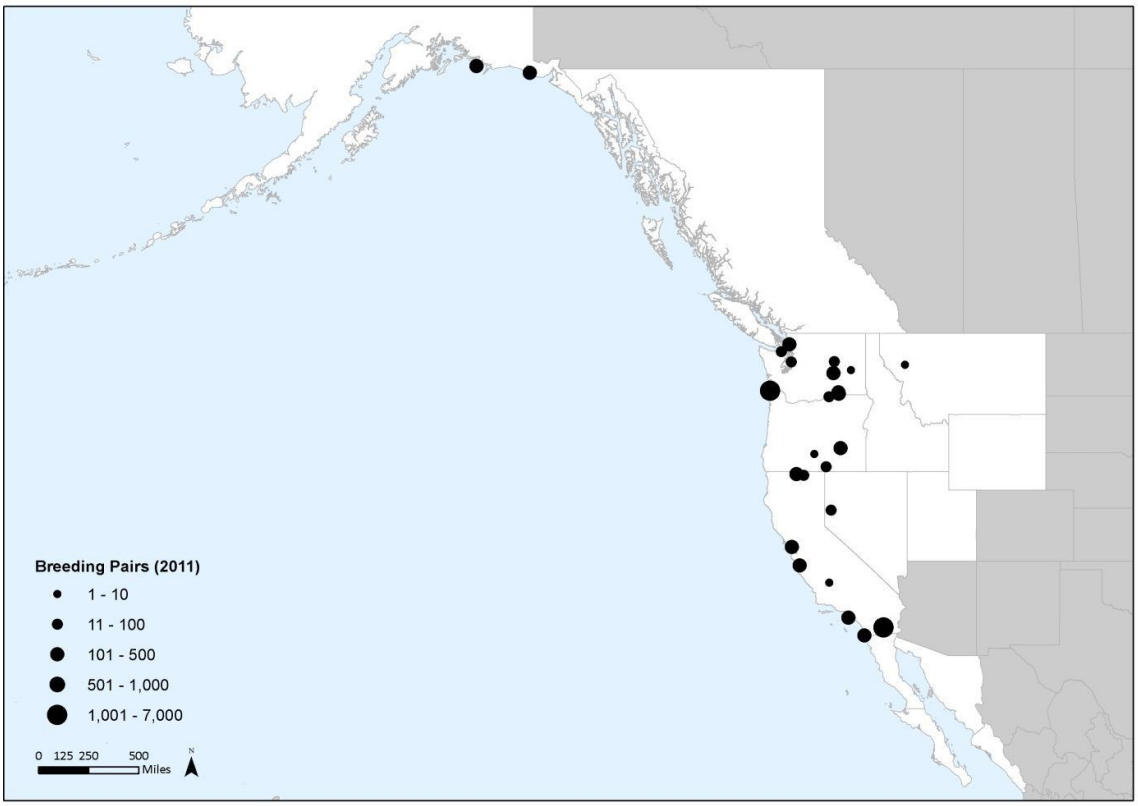

Figure 1. Nesting colonies of the Western Metapopulation of Caspian terns (from Collis et al. 2012).

Early studies on the diet of Caspian terns nesting on Rice Island indicated their consumption of juvenile salmonids was two to three times higher when compared to similar numbers of birds nesting on East Sand Island (Roby et al. 2002). Based on these studies, East Sand Island is generally considered to be the best location for piscivorous (fish-eating) water birds in the estuary in terms of their reduced impacts to juvenile salmonids. This is because East Sand Island is closer to the Pacific Ocean in more saline waters and therefore supports greater abundance and diversity of saltwater forage fish including anchovy, herring, smelt, shad, sardine, Pacific sand lance, etc. (Roby et al. 2002). Terns prey upon these forage fish when available, thus reducing the proportion of juvenile salmonids in their diets (Figure 3).

In 2000, the Corps was working to complete a project to socially attract the Caspian terns to East Sand Island and preclude nesting on Rice Island. This work was challenged under the National Environmental Policy Act (NEPA) by the Seattle Audubon Society, National Audubon Society, American Bird Conservancy, and Defenders of Wildlife. In 2002 the parties involved in the lawsuit reached a settlement agreement. This agreement allowed for the continuation of the efforts to socially attract the terns to East Sand Island but also required the Corps, U.S. Fish and Wildlife Service (USFWS), and NMFS to produce an Environmental Impact Statement (EIS) to develop a plan for managing the terns in the long term with the goal of reducing predation on juvenile salmonids. Subsequently, these federal agencies completed the *Caspian Tern Management to Reduce Predation of Juvenile Salmonids in the Columbia River Estuary Final Environmental Impact Statement* (USFWS et al. 2005). The USFWS and Corps each issued their own records of decision (RODs) in 2006 (USFWS 2006; Corps 2006). The Final Environmental Impact Statement and the two RODs documents are collectively referred to in this Environmental Assessment (EA) as the "Caspian Tern Plan."

Caspian Tern Plan

The Caspian Tern Plan called for redistribution of approximately 60% of the East Sand Island colony population via construction of new habitat (islands) in Oregon, California, and Washington. Reduction of habitat on East Sand Island would be contingent upon creation of the new islands at a nesting area ratio of 2:1. Because Caspian terns nested on an average of five acres from 2001 to 2004 on East Sand Island, approximately seven to eight acres of new suitable habitat would need to be created to reduce the East Sand Island habitat from between one to 1.5 acres (USFWS et al. 2005). The Caspian Tern Plan identified the target colony size as 3,125 to 4,375 nesting pairs over an acreage of 1.5 to 2.0 acres (with a final goal of 2,500 to 3,125 nesting pairs), but greater than expected nesting density has led to consideration of a colony size less than 1.5 acres. Islands constructed by the Corps to date are shown in Table 1; all are located east of the Cascade Range in southern Oregon and northern California except for Fern Ridge which is located in the southern Willamette Valley in Oregon.

Figure 2. Vicinity Map of East Sand Island (river mile 5), Rice Island (river mile 21), Miller Sands Spit (river mile 23) and Pillar Rock Island (river mile 27) in the Columbia River Estuary. The Corps manages these islands for placement of dredged material.

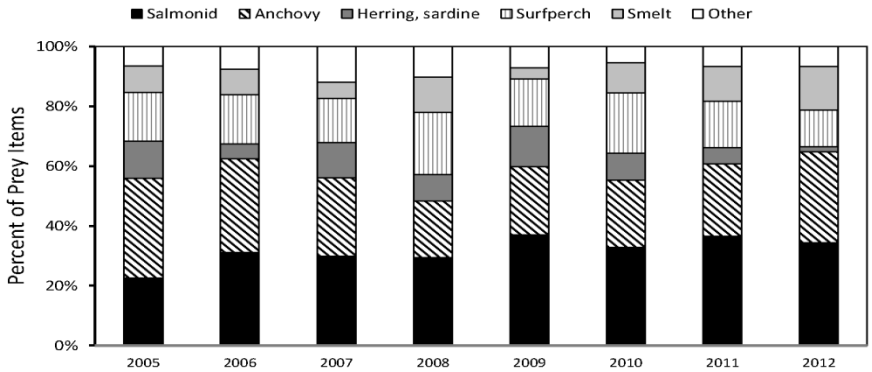

Figure 3. Annual diet composition (percent of prey items) of Caspian terns nesting on East Sand Island during 2005 to 2012 nesting seasons based on fish identified on the colony in bill loads (Roby et al. 2012 Annual Report). The varied diet is attributable to the close proximity of East Sand Island to the ocean. Data for 2013 not yet available.

Table 1. Corps constructed islands from the Caspian Tern Plan with 2013 Caspian tern nesting results (Roby et al. 2013).

State and Site Name	Land Owner	Available Area (Acres) in 2013	Estimated Number of Nesting Pairs in 2013	Fledglings Produced
OREGON				
Fern Ridge Lake, Lane County	Corps	1	0	No
Gold Dike Lake, Summer Lake Wildlife Area, Lake County	ODFW	0.5	0	No
East Link Lake, Summer Lake Wildlife Area, Lake County	ODFW	0.5	21	Yes
Crump Lake, Warner Valley, Lake County	ODSL	1	223	Yes
Dutchy Lake, Lake County[1]	ODFW	0	0	No
Malheur Lake NWR, Harney County	USFWS	1	530	Yes
CALIFORNIA				
Sheepy Lake, Klamath Basin NWR, Siskiyou County	USFWS	0.8 acre (floating)	316	Yes
Orems Unit, Klamath Basin NWR, Siskiyou County	USFWS	0.2 acre (1 acre built but 0.8 acre dry)	0	No
Tule Lake, Klamath Basin NWR, Siskiyou County	USFWS	1.35 (2 acres built but 0.65 acre dry)	79	No
Totals		6.35 acres	1,169 Nesting Pairs	

[1] Removed from the program because of unsuitable conditions for nesting.

Acreage of the Klamath Basin sites listed in Table 1 were not found to be fully suitable as defined in the Caspian Tern Plan and, therefore, only portions of the sites were counted. Predators at the sites listed in Table 1 have included gulls, great-horned owls, black-crowned night herons, raccoons, foxes, mink, coyotes, opossums, and skunks. Habitat area was used in determination of mitigation ratios under assumptions of certain nesting densities. Islands provided for terns are, of course, not year-round habitat as these birds are highly migratory but serve only to provide space for nesting colonies during spring and summer.

Before the Corps' ROD was signed, plans for the creation of habitat in Washington State were unattainable, and a modified alternative was selected which involved constructing seven acres of new habitat and ultimately reducing East Sand Island habitat to 1.5 to two acres. It was expected that reducing East Sand Island habitat by this amount would result in an estimated colony size of 3,125 to 4,375. Through identification and creation of new habitat, the acreage on East Sand Island could ultimately be reduced to one acre if other alternative sites were found, enhanced, or created. Potential coastal relocation sites that had been considered in Oregon were also deemed unsuitable because of concerns over introducing predation on fish stocks that had not been historically subjected to Caspian tern predation; thus these coastal sites were not incorporated into alternatives considered

in the Caspian Tern Plan. Creation and/or enhancement of site(s) along the coast would likely provide habitat for large colonies because of availability of marine forage fish, without having large concerns from the perspective of ESA. The Oregon Department of Fish and Wildlife (ODFW) periodically inspects potential coastal sites and has not observed Caspian terns; these locations include three sites in Coos Bay and two sites in the Umpqua River Estuary (communication with Lindsay J. Adrean, ODFW, February 21, 2014). Based on a habitat assessment from an aerial survey, USFWS (2003) determined that only these two estuaries contained sites that might serve as nesting habitat for Caspian terns.

In 2008, implementation of the Caspian Tern Plan began. Over the last four years, the Corps has constructed 8.3 acres of new habitat to compensate for habitat reduction which has occurred over that time on East Sand Island. Dutchy Lake (0.5 acre) was eliminated from the program in 2012 because of unsuitable nesting conditions due to submergence, leaving the current inland habitat acreage at 6.35 (Table 1). In 2012, available habitat for the Caspian tern colony was reduced to 1.58 acres on East Sand Island (Figure 4). Habitat reduction is accomplished by allowing vegetation to grow in naturally. Every year the designated colony area is prepared by tilling the soil and removing the encroaching vegetation to achieve the desired bare sand nesting habitat for the terns (Figure 5). Implementation of the Caspian Tern Plan calls for the USFWS to monitor the tern's regional population to ensure the conservation goals for Caspian terns are being met.

The Corps' 2006 ROD was incorporated into the 2008 Federal Columbia River Power System (FCRPS) Biological Opinion (NMFS 2008) as reasonable and prudent alternatives. This requires the Corps to monitor and report to NMFS the number of acreage available and breeding pairs on East Sand Island and on the newly constructed islands and report on the consumption rates on juvenile salmonids at East Sand Island.

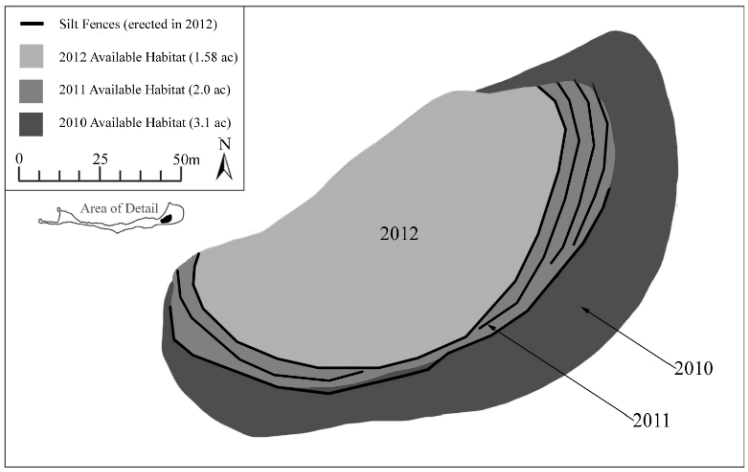

Figure 4. Nesting habitat acreage prepared for Caspian terns on the eastern end of East Sand Island in the Columbia River Estuary from 2010 to 2012 (Bird Research Northwest). The area nesting area provided in 2013 was the same as 2012.

Figure 5. Caspian Tern Colony on the eastern portion of East Sand Island, 2012. Silt fences in vegetated areas show former boundaries of the colony (photo by Bird Research Northwest). The area nesting area provided in 2013 was the same as 2012.

Adaptive Management

Recognizing the difficult and often unpredictable situation of trying to manage the largest colony of Caspian terns in the world, the Caspian Tern Plan called for an Adaptive Management Plan. In 2012, an inter-agency Adaptive Management Team began meeting to discuss the effectiveness of the plan and to make recommendations to the Corps on taking new courses of actions. These recommendations are based upon the responses of Caspian terns to management efforts. Members of the Adaptive Management Team include USFWS, NMFS, Corps, and the Bonneville Power Administration (BPA); BPA funds the monitoring of terns on East Sand Island.

Predictions were made in the Caspian Tern Plan as to how many nesting pairs would occupy a reduced habitat area. Based on previous nesting densities on East Sand Island and Rice Island, it was expected that the 1.5 to two acres of prepared habitat would be adequate to provide for a colony range of 3,125 to 4,375 breeding pairs. It was also believed that the proposed acreage and associated colony size would be suitable to encourage social attraction and prevent colony abandonment.

During implementation of the Caspian Tern Plan, the response from Caspian terns was unexpected as to how many nesting pairs would occupy available habitat. In 2012, nesting density at the East Sand Island tern colony increased to 1.06 nests per square

meter which was the highest nesting density ever observed at this colony (Roby et al. 2013). In 2013, density was even slightly higher, at approximately 1.1 nests per square meter; approximately 7,111 nesting pairs occupied the space that was intended for 3,125 to 4,375 pairs (Roby et al. 2013).

Caspian terns have also attempted (and have had limited success in nesting) along the eastern shore of East Sand Island outside of the designated 1.58 acre colony area (Roby et al. 2012 Annual Report). Dissuasion and hazing of Caspian terns, which involved placement of posts, flagging, and ropes to modify suitable habitat and prevent nesting, was implemented with success on East Sand Island with the intention of containing the colony to the designated and maintained area.

One factor not anticipated in the Caspian Tern Plan and of immediate concern to the Adaptive Management Team is the impact native predators are having on the colony's productivity (number of young raised per breeding pair). The nesting seasons of 2010 through 2013) showed low productivity for the colony. In 2011, the colony did not produce a single fledgling (Figure 6). The low productivity in 2011 and 2012 of the Caspian tern colony was caused primarily by egg predation by glaucous-winged x western gull hybrids that preyed upon tern eggs and chicks after bald eagles flushed the adults from the colony (Roby et al. 2012 Annual Report). This most often occurred in the evening, which increased the occurrence of adult terns leaving the colony until the next day, making eggs and nestlings even more susceptible to additional predation. The threat of adult mortality, as with bald eagle disturbance, also can cause permanent nest abandonment (Cuthbert 1988). Nest predation is considered to be a primary factor influencing Caspian tern production and nest-site fidelity (Cuthbert 1988; Danchin et al.1998; Strong et al. 2004). Suryan et al. (2004) modeled the Pacific Coast population of Caspian terns and estimated that 0.32 to 0.74 fledglings per pair are required to maintain a stable population. From Figure 6, production at East Sand Island has been well below 0.32 since 2010, with a high of approximately 0.2 in 2013.

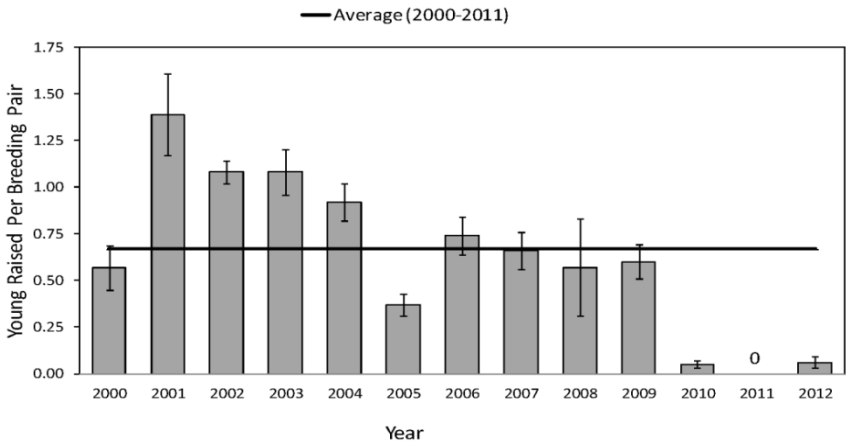

Figure 6. Caspian tern nesting success (average number of young raised per breeding pair) at the breeding colony on East Sand Island in the Columbia River Estuary during 2000 to 2012 (Roby et al.

2012 Annual Report). The error bars represent 95% confidence intervals. Data for 2013 not yet available, but estimate was approximately 0.2 young raised per breeding pair.

In 2012 the Corps lethally removed 50 glaucous-winged x western gull hybrids under a permit from the USFWS; this represented about 1% of the local population. The lethal removal of gulls began on May 5, 2012 and lasted until June 15, 2012. Despite efforts to remove predatory gulls, terns had very little reproductive success, raising only 400 young for the entire colony of 6,400 pairs. When the allowable number of gulls was removed in 2012, there was still a considerable amount of tern nest predation by gulls. Caspian terns increased on the colony at East Sand Island in 2013 to approximately 7,111 pairs with the number of young raised per nesting pair increasing to near 0.2 (Roby et al. 2013), the highest rate of fledging since 2009. Production was higher than 0.32 from 2000 through 2009 and higher than 0.74 from 2001 through 2004.

Caspian Tern Management in the Estuary, Upriver of East Sand Island

To address concerns about the Caspian terns' potential to go upriver and consume greater numbers of salmon, the Caspian Tern Plan called for dissuasion and hazing at Rice Island, Miller Sands Spit, and Pillar Rock Island. The Corps uses these islands on a semi-regular basis to place dredged material, thereby creating suitable temporary open sand nesting habitat for the terns. Hazing was also a requirement of the Biological Opinion for Columbia River channel operations and maintenance (NMFS 2005).

Recent efforts to dissuade and haze the birds have only been necessary on Rice Island, as the birds have not exhibited nesting behavior on Miller Sands Spit or Pillar Rock Islands (Roby et al. 2012 Annual Report). Rice Island and Miller Sands Spit are the two most likely places Caspian terns may seek out for roosting or nesting as relatively recent placement of dredged material and clearing for that placement have created some suitable habitat with only sparse vegetation. Caspian terns have used Rice Island and Miller Sands Spit for roosting and adjacent waters for foraging but their use of the islands in this way, as observed by monitors and hazers, has been limited to the mud flats.

Placement of material on Miller Sands Spit occurs on annual or bi-annual basis and typically only on the shore where it erodes through natural processes. In 2012, dredged material placed on Miller Sands Spit was contoured to establish mounds that were effective in making the newly created habitat less suitable for Caspian tern nesting. This was effective because it limited sight distance of terns when perched on the ground.

Methods used on Rice Island have primarily consisted of using wood stakes and flagging to modify suitable nesting habitat for terns (Figure 7). Hazing efforts also include presence of humans (hazers) to flush the birds away from the island. The Caspian Tern Plan also called for other measures to prevent terns from using these islands, such as establishing vegetation to make habitat unsuitable for nesting, using eagle kites, personnel with dogs, and all terrain vehicles (ATV) to cover distances effectively. These efforts begin April 1 and continue to June 15 each year (USFWS et al. 2005).

To assist in preventing the establishment of new tern colonies on Rice Island, Miller Sands Spit, and Pillar Rock Island, the USFWS (per the Caspian Tern Plan) would issue a depredation permit annually to the Corps to collect eggs, should hazing with non-lethal methods fail to prevent tern nesting. Since the implementation of the Caspian Tern Plan, a total of 10 eggs have been collected under permit, all from Rice Island. The Corps was issued a permit to collect 100 Caspian tern eggs each year from 2009 to 2013.

Figure 7. Wood stakes with rope and flagging used to make Caspian tern nesting habitat unsuitable on Rice Island.

Periodic boat-based and aerial surveys of Rice Island, Miller Sands Spit, and Pillar Rock Island are conducted annually during the breeding season in order to detect signs of nesting attempts by Caspian terns. In May of 2009, one year after implementation of the Caspian Tern Plan, approximately 520 Caspian terns were observed loafing on upland areas of Rice Island, and their observed behavior (courtship displays, exchange of courtship meals, copulations, and digging of nest scrapes) indicated an intention to nest (Roby et al. 2010 Annual Report). Stakes and flagging were put out in these areas, and terns were successfully dissuaded from nesting. The following year in May, approximately 75 Caspian terns were observed in an upland area east of the old colony site on Rice Island and were again effectively hazed off the island by placing stakes and flagging on the island (Roby et al. 2011 Annual Report).

In April of 2011, Caspian terns appeared interested in nesting at Rice Island near the former colony site that was used in the 1990s and on a pier at Tongue Point. Stakes with flagging were erected in the areas where terns were attempting to nest, and human hazers were on the island attempting to keep the birds off until June 15 when hazing ended. Caspian terns returned to Rice Island in late June and initiated nesting there. In July, three Caspian tern nests, with a total of four eggs, were discovered on Rice Island adjacent the old colony site and near areas that had previously been staked and flagged to prevent tern

nesting. In August, approximately 460 adult Caspian terns (most were roosting) and three tern chicks were observed at the colony site on Rice Island (Roby et al. 2012 Annual Report). In 2012 and 2013, efforts to dissuade terns from nesting on Rice Island were successful.

Current Hazing Operations in the Estuary

Caspian tern hazing occurs annually on Rice Island, Pillar Rock Island, and Miller Sands Spit in the Columbia River Estuary upriver of East Sand Island. Two sessions of monitoring have occurred each day of monitoring; once in the morning (beginning before 8:00 AM) and once in the afternoon (beginning after 2:00 PM). A total of 27 days of monitoring occurs from April 16 through June 15, the peak nesting season for Caspian terns. Patrols begin April 16 and occur every three days until May 1 when they are done every other day, until June 9 when they occur every three days until the 15 of June. Observation of Caspian terns are done by monitors using binoculars to scan the islands. Monitors access the island by boat.

Specific hazing actions for each island are as follows:

Monitoring on Rice Island: During both am and pm shifts of each monitoring day; monitors access Rice Island and walk from the southwest corner in a northeasterly direction to the north shore of the island while scanning for Caspian terns. The high points of Rice Island are accessed during one of the sessions per week and the island scanned for Caspian terns.

Monitoring on Pillar Rock Island: During both am and pm shifts of each monitoring day; monitors access Pillar Rock Sands on the north shore and walk to a point south where the whole dredge spoil area can be scanned for Caspian terns.

Monitoring on Miller Sands Spit: Only requires access by foot if Caspian terns are seen from the boat attempting to nest. Caspian terns are immediately dissuaded from nesting by installing wooden stakes at least three feet tall with 4-mil flagging secured to the stakes in the areas of attempted nesting; one flag per stake with a length after tying of a minimum of two feet. Stakes are placed a minimum of 10 feet apart. Yellow poly rope will be used in conjunction with the flagging for this dissuasion. It is likely that the area per dissuasion event would involve a minimum of 0.25 acre and up to a maximum of three acres of staking and flagging.

In addition to hazing, collection of up to 100 Caspian tern eggs occur only under USFWS Migratory Bird Permit. Eggs are collected only from Rice and Pillar Rock Islands and Miller Sands Spit and be refrigerated for delivery to the Corps or Oregon State University (OSU) representatives.

Caspian Tern Management Upriver on the Columbia Plateau

In January of 2014, the U.S. Army Corps of Engineers, Walla Walla District completed an Inland Avian Predation Management Plan (Inland Plan) and EA for inland avian predation (Corps 2014d). The Inland Plan aims to reduce avian predation-related loss of ESA-listed juvenile salmonids in the mid-Columbia River Basin above Bonneville Dam (the Columbia Plateau), far upriver of the Columbia River Estuary. The development of the Inland Plan was a requirement of the NMFS 2008 FCRPS Biological Opinion, Reasonable and Prudent Alternative (RPA) 47, as updated in the NMFS 2010 supplemental Biological Opinion.

Fish consumption by Caspian terns nesting on the Columbia Plateau is mainly juvenile salmonids (Corps 2014d); the area of course doesn't provide marine forage fish that is so effective in reducing predation on juvenile salmonids in the lower Columbia River Estuary. Research presented in the Inland Plan indicated that the greatest potential for increasing juvenile salmonid survival through the reduction in losses to avian predators on the Columbia Plateau would be gained by focusing management efforts on dissuading Caspian terns from nesting at Goose Island and Crescent Island. For 2014, complete dissuasion is planned at Goose Island, where approximately 400 pairs have nested in recent years. Management actions in the Columbia Plateau are discussed later in the Cumulative Effects section.

Caspian Tern Nesting Pairs, Density, and Acreage at East Sand Island

The Caspian Tern Plan has been implemented with some success. To date, habitat creation and enhancement in interior Oregon and California has allowed for incremental reduction in Caspian tern nesting habitat on East Sand Island. These inland sites are listed in Table 1. Nesting success has varied among sites due to habitat suitability, forage fish availability, and predation on eggs and chicks. Creation of multiple nesting colonies is desirable because it disperses the regional population and lessens the chance of potential effects of catastrophic local events on, for example, one large colony.

Management of Caspian terns in the Columbia River Estuary is intrinsically challenging because of the need to satisfy competing interests; the well being of the Caspian tern colony in the Columbia River Estuary and the ESA-listed salmonids upon which they prey. Caspian terns are of conservation concern on a global scale because the worldwide population probably does not exceed 100,000 pairs, colonies are generally small and scattered over large areas, and populations have declined over much of their former range (Collis et al. 2002). Current nesting colonies shown in Figure 1are far reduced from historical numbers and distribution of colonies in the western U.S. (Figure 8). Because of habitat modification and water management, colonies have been virtually eliminated from the interior states of the west.

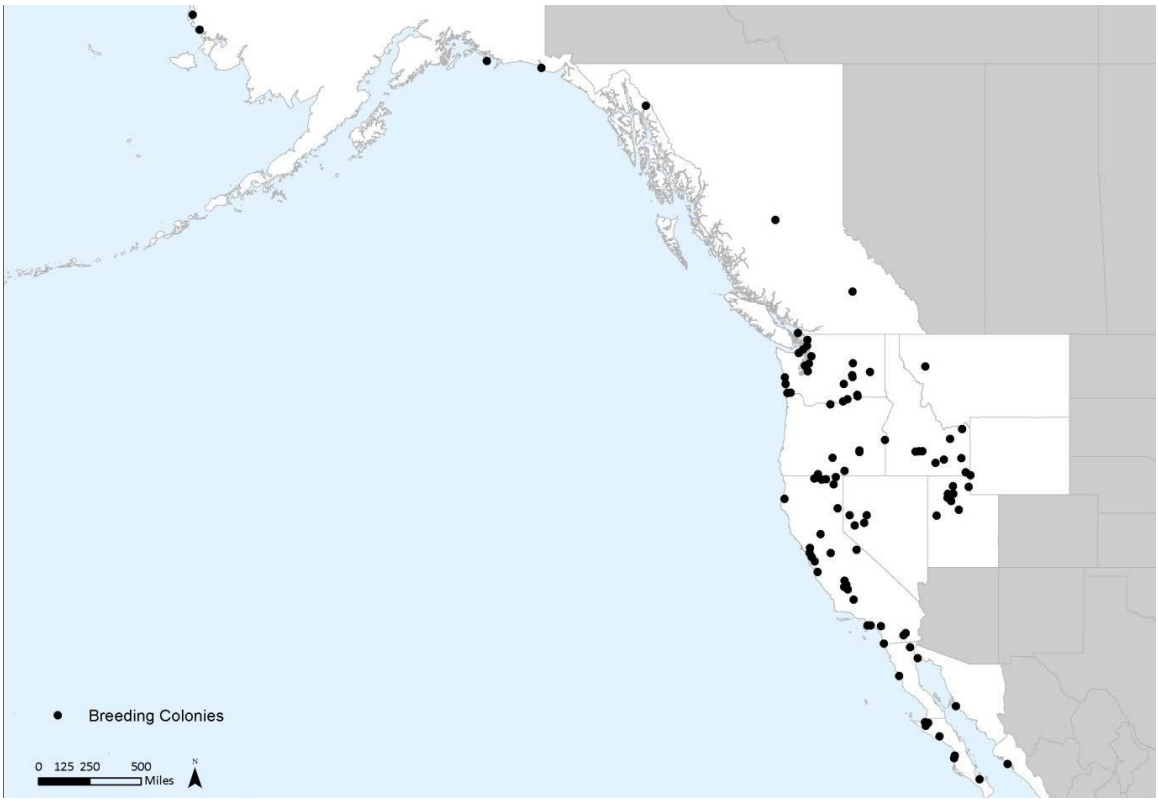

Figure 8. Distribution of current and historical Caspian tern nesting colonies in the Western Metapopulation (from Collis et al. 2012). A marked reduction in distribution is evident when comparing this figure to Figure 1.

The East Sand Island Caspian tern colony is the largest in the world in terms of nesting pairs and is atypical in size; the colony supports the majority of the Western Metapopulation. The Caspian Tern Plan targeted approximately 3,125 to 4,375 nesting pairs on East Sand Island with reduction of nesting habitat to between 1.5 and two acres, resulting in a predicted one percent or greater increase in population growth rates for four Columbia River Basin steelhead ESUs. Steelhead were used in model predictions because they are more susceptible to tern predation than other salmonid ESUs in the Columbia River Basin.

Reduction of nesting area available for terns on East Sand Island has not produced the desired results of diminishing the tern population there, however. Numbers of nesting pairs have remained high because of the unexpected increased density of nesting pairs on the colony, which were approximately 7,111 in 2013 (Roby et al. 2013). It is unknown if further reduction to the size of the nesting colony on East Sand Island would result in even greater density of nesters; no studies have attempted to determine the minimum area required for a nesting pair. Greater nesting densities on East Sand Island are conceivable, however, because of densities recorded on the Commencement Bay tern barge in south Puget Sound, which were higher than ever recorded on East Sand Island at approximately 1.5 pairs per square meter (Collis et al. 2002). Portions of Crescent Island in the Columbia Plateau Region had densities as high as 1.48 pairs per square meter over some

of the colony. The barge is an unnatural site and it is unknown if Caspian terns would nest at this high of a density on the East Sand Island colony even if there were enough birds there to do so. Brooks Island, a natural island in San Francisco Bay, showed a similar nesting density to East Sand Island in 2013 (OSU et al. 2013a). From comparing Figures 10 and 14, numbers of nesting pairs on East Sand Island appears to be a good predictor of numbers of juvenile salmonids consumed.

CHAPTER 2
PURPOSE AND NEED FOR ACTION

Purpose:

The purpose of the Proposed Action is to address actions called for in the 2008/2010 FCRPS Biological Opinion. RPA 45 requires implementation of a Caspian Tern Management Plan and RPA 66 requires evaluation of the effectiveness of the plan. The Proposed Action of the Draft EA was considered adaptive management towards meeting the purpose and need of the Caspian Tern Plan and fulfilling expected salmonid survival improvements per the FCRPS Biological Opinion.

Need:

The actions taken per the Caspian Tern Plan and Corps' ROD did not result in the anticipated reduction of consumption of juvenile salmonids by Caspian terns. The amount of nesting habitat available to Caspian terns on East Sand Island has been reduced since 2006 from about 6.5 acres to the current 1.58 acres. Year 2013 marked the third year that Caspian tern habitat was managed between 1.58 to two acres. This reduction was expected to result in 3,125 to 4,375 nesting pairs as identified in the ROD (for 1.5 to two acres). Despite incremental reductions in the amount of nesting habitat, numbers of nesting pairs and amount of predation on juvenile salmonids have remained fairly constant. In 2013, at 1.58 acres of nesting habitat on East Sand Island, the number of nesting pairs was near 7,111 and predation on juvenile salmonids was near 4.7 million (Roby et. al. 2013). Neither the FCRPS Biological Opinion objectives for juvenile salmon survival nor the purpose and need of the Caspian Tern Plan have been met. This indicates that additional actions are needed.

CHAPTER 3
ALTERNATIVES

No Action Alternative: Continue Current Management

The No Action Alternative would continue the current management of Caspian terns on East Sand Island and the constructed tern colonies in interior Oregon and Northern California as defined by the Caspian Tern Management Plan and as described above. Current management of terns on East Sand Island includes the following:

- Designate colony area: Delineate 1.58 acres of Caspian tern nesting habitat.

- Habitat quality: Habitat within the designated Caspian tern colony would be prepared to provide suitable nesting habitat. Site preparation may include eliminating vegetation and using an ATV and disk to till the site and smooth the surface prior to the nesting season.

- Dissuasion on East Sand Island: Caspian terns attempting to nest outside of the designated colony would be hazed via non-lethal methods (passive hazing involving habitat modification supplemented by active human hazing) during the peak nesting season (March through mid-June). Passive hazing (e.g. placement of stakes and flags) would not occur below mean higher high water since frequent inundation would prevent nesting. Dissuasion will occur from March 21 – April 15, prior to nesting, along the eastern shore (approximately three acres) and toward the western end of the island (approximately two acres). With dropping river levels during the nesting season, additional areas along the eastern shore will become exposed and become potential nesting habitat; as much as 1.5 additional acres may need to be dissuaded during the nesting season at this location. Transport of dissuasion materials would be by ATV.

- Dissuasion in the Columbia River Estuary: Dissuasion and hazing Caspian terns from Rice Island, Pillar Rock Island, and Miller Sands Spit (all located upriver of East Sand Island) would continue under the Corps' dredging program and would allow for collection of up to 100 Caspian tern eggs on these islands. Caspian tern would be prevented from nesting using passive and active non-lethal hazing methods, as described for East Sand Island above.

- Monitor on East Sand Island: Monitoring of the East Sand Island designated colony would occur while employing previously constructed blinds. Monitoring would include numbers of nesting pairs, productivity, presence and impact of predators, and predation on fish via bill load observations.

- Monitor at the constructed islands: On the constructed islands for Caspian terns in interior Oregon and northern California, social attraction, predator management, vegetation management, and monitoring would continue until the target colony size on East Sand Island (2,500 to 3,125 nesting pairs) is met.

- Seek coastal nesting site: Under current management, the Corps would continue searching for a viable coastal nesting site for Caspian terns and would not consider reducing Caspian tern nesting habitat on East Sand Island until a coastal site is identified and made available to terns.

Proposed Action of the Draft EA: Reduce Designated Colony to 1.08 acres and Other Actions

This alternative would continue all of the activities described above in the No Action Alternative with the following exceptions:

- Designate colony area: The designated Caspian tern colony area would be reduced from 1.58 to 1.08 acres. Habitat reduction on the designated colony at East Sand Island would be achieved via placing barriers (fencing, sticks, flags, ropes, stakes, etc…) prior to the nesting season.

- Dissuade and haze on East Sand Island: Because terns have expressed high nest fidelity over the course of management (terns that hatched or nested at East Sand Island returning to East Sand Island), an increased effort in hazing and habitat modification would likely be necessary on the eastern and western portions of East Sand Island especially during the during the peak nesting season: March through mid-June. Transport of dissuasion materials would be by ATV.

- Dissuade and haze in the Columbia River Estuary: Dissuasion and hazing of terns from Rice Island, Pillar Rock Island, and Miller Sands Spit would occur, perhaps with greater intensity than in the past. Actions would include collecting up to 100 Caspian tern eggs on these islands and prevention of terns from nesting using non-lethal methods (habitat modification and human hazing).

- Seek alternative coastal nesting site: The Corps would continue searching for a viable coastal nesting site in 2014, while tern habitat on East Sand Island is reduced.

CHAPTER 4
AFFECTED ENVIRONMENT

A detailed description of the affected environment is provided in the Caspian Tern Plan (USFWS et al. 2005) and incorporated by reference; additional information specifically pertinent to this EA is provided below.

East Sand Island is located in the Columbia River Estuary near the mouth of the Columbia River in Clatsop County, Oregon, approximately one mile west of Chinook, Washington and 10 miles northwest of Astoria, Oregon. The island, approximately 50 acres in size, was once connected to Sand Island, just to the northeast in Baker Bay. The islands have separated over time due to erosion. In 1954, East Sand Island was transferred to the Corps for the Sand Island Channel Improvement Project.

Currently a variety of breeding seabirds and water birds nest on East Sand Island. Because of the large numbers and diversity of birds using the island, the American Bird Conservancy and the National Audubon Society recognize it as an Important Bird Area and Western Hemisphere Shorebird Reserve.

Miller Sands Spit and Rice Island, located upriver of East Sand Island in the Columbia River Estuary, are used regularly for placement of dredged material by the Corps and are characterized by large expanses of bare sandy ground with areas of sparse grasses, forbs and small shrubs. These islands are a unique, almost desert-like habitat in the estuary (USFWS 2010). Sparse vegetation and the scarcity of mammalian predators make the islands attractive nesting locations for Caspian terns and other colonial waterbirds. Control of mammalian predators has been necessary for establishment of inland Caspian tern nesting colonies, but has not been an issue with islands in the estuary. Canada geese and streaked horned lark also nest on islands in the estuary (USFWS 2010). The off-channel edges of the islands slope into shrubby willows and cottonwoods near the water's edge and then into tidal marsh and shallow flats. These shallows attract large numbers of wintering ducks, as well as migrating shorebirds and juvenile salmonids (USFWS 2010).

The Caspian terns' migration to the lower Columbia River Estuary has dramatically changed distribution of the Western Regional Population. Caspian tern breeding was first documented in the Columbia River Estuary in 1984 when approximately 1,000 terns were reported nesting on fresh dredged material disposed on East Sand Island. Prior to 1984, the species was a non-breeding summer resident of the lower Columbia River. In 1986, possibly because of vegetation development on East Sand Island, the colony moved to Rice Island where they nested until the Corps took an action to relocate the terns via social attraction to East Sand Island, closer to the ocean, in order to decrease the percentage of juvenile salmonids in the diet of terns.

To compensate for reduction in area of the nesting colony on East Sand Island over the years, eight inland nesting areas have been established for Caspian terns in Oregon and

northern California (Table 1) totaling 6.35 acres. Of these eight nesting locations, 5 were used in 2013 supporting a total of 1,169 nesting pairs. Of these eight locations, seven are east of the Cascade Range in Lake, Klamath, and Harney Counties in Oregon and Siskiyou County, California. One location is in the Willamette Valley in Lane County, Oregon.

CHAPTER 5
EFFECTS OF THE ALTERNATIVES

Effects of the actions described in the Caspian Tern Plan and incorporated by reference, except as noted in this text.

ESA-listed Species and Caspian Terns:

Proposed Action of the Draft EA:

Implementation of the Proposed Action was considered in the Draft EA to be corrective measure to reduce predation on juvenile Columbia River Basin ESA-listed salmonids with the goal, per the Caspian tern plan, to redistribute approximately 60% of the tern population of the East Sand Island colony.

East Sand Island is the largest Caspian tern colony in the world (Roby et al. 2012 Annual Report) and approximately 60% of the Pacific coast regional population currently nests on East Sand Island (USFWS et al. 2005). The Western Metapopulation has increased from approximately 6,218 pairs from 1976 to 1982 to approximately 11,660 in 2011 (Spendelow and Patton 1988; Corps 2014d).

Caspian terns nest on the eastern portion of East Sand Island and are separated from the cormorant colony on the western portion of the island by dense upland shrub habitat. The number of adult Caspian terns on the East Sand Island colony peaks in mid-May (Figures 9 and 11), which corresponds to the peak period of migration of juvenile salmonids (many released from upriver hatcheries) through the estuary (Figures 9 and 10). In 2012, however, Caspian terns remained on the colony in good numbers into August; this was likely because of intense gull depredation on chicks and eggs.

The number of breeding tern pairs on East Sand Island peaked in 2008 and trended downward through 2012 (Figure 10) as colony size has gradually been reduced, but increased in 2013 despite nesting acreage remaining constant from 2012 to 2013. In the past three years, the colony has experienced very low nesting success (Figure 6). In 2011, the colony did not produce any young; this was the only time that a complete breeding failure has occurred at this colony (Roby et al. 2012 Annual Report). The decline in productivity and colony size is attributed to intense disturbance by bald eagles and associated gull predation on tern eggs and chicks. In 2012, the Corps lethally removed 50 glaucous-winged x western hybrid gull hybrids under a permit from USFWS. The lethal removal lasted from May 5th through June 15th with 40 gulls removed in May and 10 in June. In spite of the removal of predatory gulls in 2012, only approximately 400 Caspian tern fledglings were raised by a colony of approximately 6,400 breeding pairs. It is difficult to predict future Caspian tern production on East Sand Island especially in light of gull depredation on chicks and eggs in recent years, where large colonies on East Sand Island have produced few young.

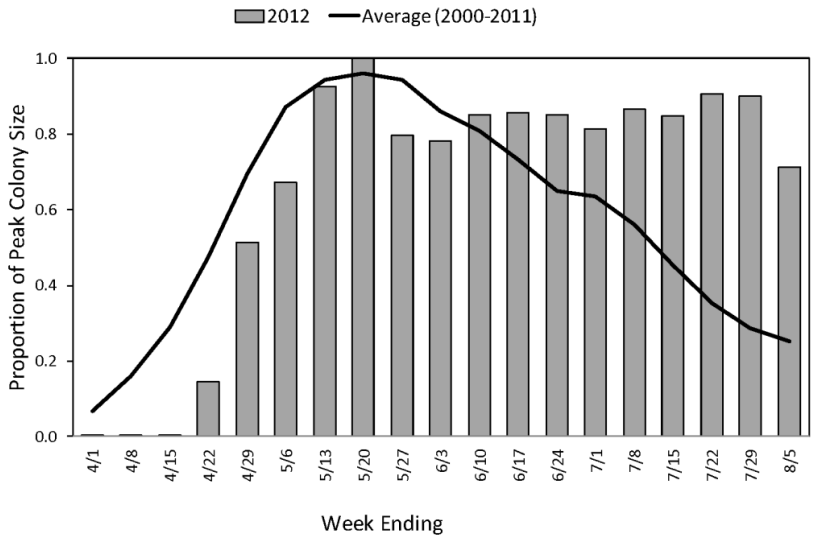

Figure 9. Weekly estimates from the ground of the number of adult Caspian terns on the East Sand Island colony during the 2012 breeding season, relative to peak colony attendance determined from counts of aerial photography taken late in the incubation period (Roby et al. 2012 Annual Report). Data for 2013 not yet available.

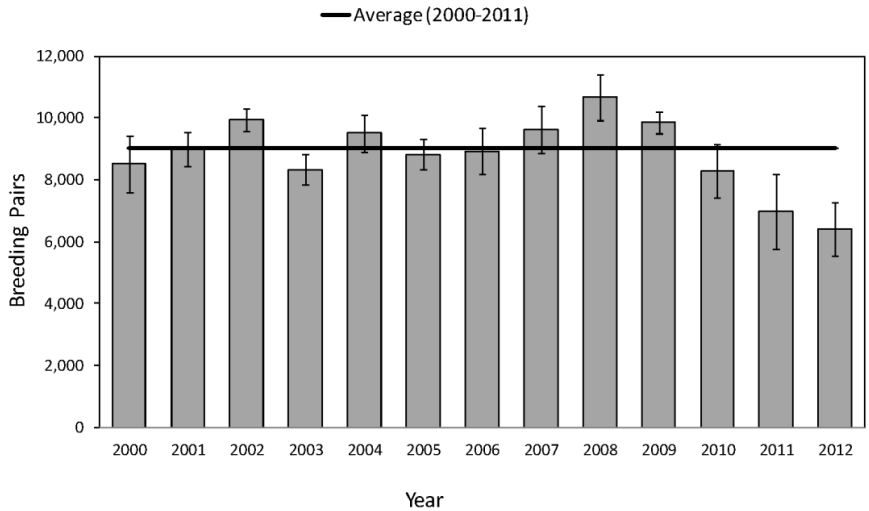

Figure 10. Number of breeding pairs of Caspian terns on East Sand Island (Roby et al. 2012 Annual Report). Data for 2013 not yet available, but estimate was near 7,111 (Roby et al. 2013). The error bars represent 95% confidence intervals.

Climate conditions associated with a strong La Niña and the resultant exceptionally high river flows also apparently contributed to the lack of nesting success by affecting the availability of marine forage fish (Roby et al. 2012 Annual Report). Also, disturbance rate of Caspian terns from bald eagles on East Sand Island has been positively related to May river discharge (Roby et al. 2013). Nesting success has been negatively related to June river discharge (Roby et al. 2013). Greater river discharge is thought to negatively affect the availability of marine forage fish (Roby et al. 2011 Annual Report) and decrease water clarity (Hostetter et al. 2012).

Thirteen ESA-listed Evolutionarily Significant Units (ESUs) comprising five species of Columbia River Basin salmonids occur in the Columbia River Estuary (Table 2).

Table 2. ESA statuses and juvenile migration strategy of the 13 ESUs occurring in the Columbia River Estuary.

Evolutionarily Significant Unit	Status	Juvenile Migration	ESA Listing Date
Chinook Salmon			
• Upper Columbia River Spring Run	Endangered	Yearling	3/24/1999
• Lower Columbia River	Threatened	Sub-yearling	3/24/1999
• Upper Willamette River	Threatened	Yearling	3/24/1999
• Snake River Spring/Summer Run	Threatened	Yearling	4/22/1992
• Snake River Fall Run	Threatened	Sub-yearling	4/22/1992
Coho Salmon			
• Lower Columbia River	Threatened	Yearling	3/24/1999
Chum Salmon			
• Columbia River	Threatened	Sub-yearling	3/24/1999
Sockeye Salmon			
• Snake River	Endangered	Yearling	11/2/1991
Steelhead			
• Upper Columbia River	Threatened	Yearling	8/18/1997
• Middle Columbia River	Threatened	Yearling	3/25/1999
• Lower Columbia River	Threatened	Yearling	3/19/1998
• Snake River	Threatened	Yearling	8/18/1997
• Upper Willamette River	Threatened	Yearling	3/25/1999

Predation on juvenile salmonids from avian predators is listed as one of the factors potentially limiting the recovery of Columbia Basin salmonid runs (NMFS 2008). Under the Proposed Action of the Draft EA, the acreage for the Caspian tern colony on East Sand Island would be reduced by 0.5 acre, from 1.58 acres to 1.08 acres (a 31.6% reduction in nesting area). This was considered in the Draft EA as a response to unexpected high densities of nesting Caspian terns on East Sand Island in 2013 and was seen as a corrective measure to alleviate predation on juvenile salmonids, in the long term, and undesired expansion of the Caspian tern population in the Columbia River

Estuary in future years. As noted above, East Sand Island is the largest Caspian tern nesting colony in the world and is abnormally large for this species, and a 0.5-acre reduction in colony area is predicted to lower the number of nesters on East Sand Island in 2014 compared to 2013.

As noted above, peak occurrence of juvenile salmonids in the Columbia River Estuary on their migration to the ocean occurs from April to July, which coincides with the nesting season of Caspian terns on East Sand Island (Figure 9 and 11). Of the five species of ESA-listed salmonids in the Columbia River Estuary, steelhead, coho, and Chinook are most susceptible to predation from the East Sand Island tern colony based on numbers of individuals taken (Figure 12).

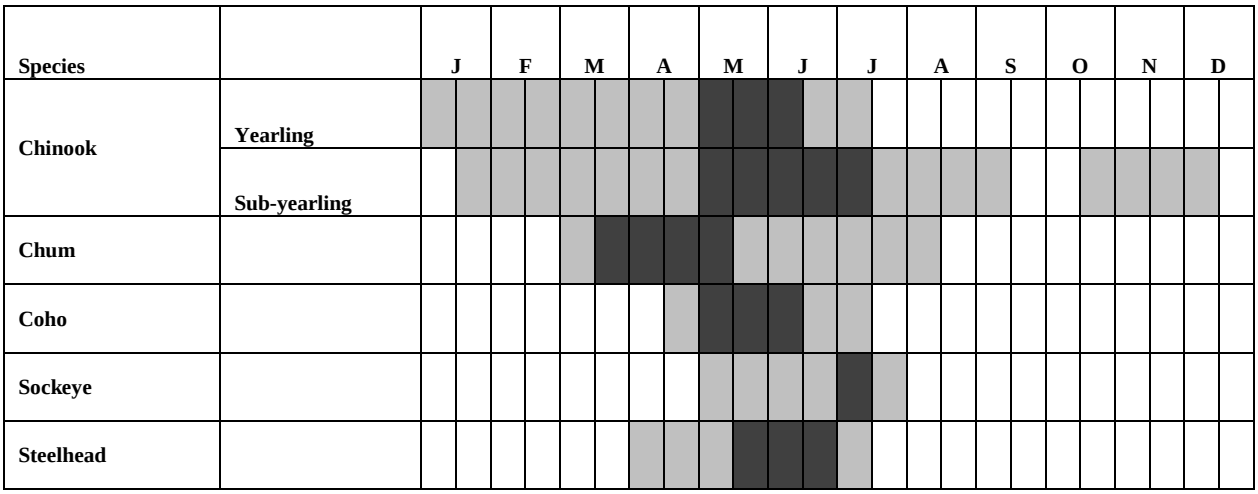

Figure 11. Migration timing of juvenile salmon and steelhead (stock composite) in the lower Columbia River (based on Dawley et al. 1986; data gaps for sub-yearling Chinook in mid-September to mid-October and mid-December to mid-January are due to no sampling efforts). Dark shading represents peak (high abundance) migration/rearing and light shading represents non-peak (lower abundance) migration/rearing.

It is interesting that chum salmon appear to not to be susceptible to Caspian tern predation. This may be related to the small size of juveniles occurring in the estuary; chum salmon outmigrate shortly after hatching; Hostetter et al. (2012) found that size (fork length) was an important factor in susceptibility of juvenile steelhead to Caspian tern predation (Figure 13). Peak susceptibility was at a fork length of 202 mm (20.2 cm) and decreased in larger and smaller fish. Also note from Figure 12 that during most years, smaller sub-yearling Chinook salmon were less prevalent in the Caspian tern diet than the larger yearling Chinook.

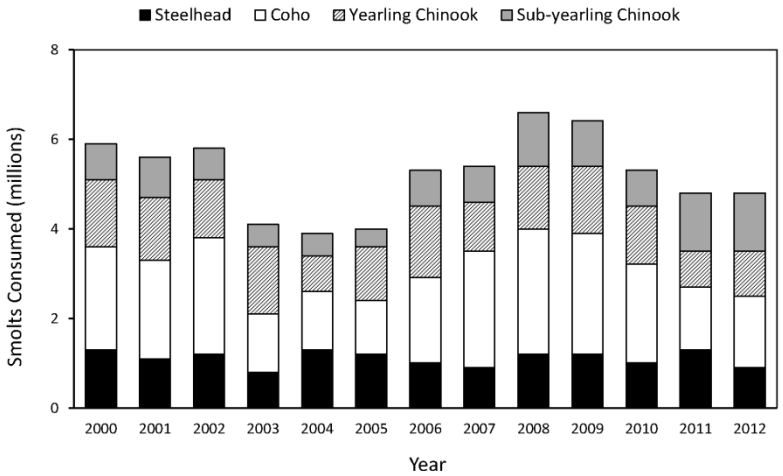

Figure 12. Estimated total annual consumption of steelhead, coho, and Chinook by Caspian terns nesting on East Sand Island during the 2000 to 2012 nesting seasons. Estimates based on fish collected from tern bill loads near the colony and bioenergetics calculations (Roby et al. 2012 Annual Report).

Juvenile salmonid consumption by Caspian terns has remained fairly constant for the East Sand Island colony since the year 2000 (Figure 14). One possible explanation for the rather static consumption totals is that nesting birds that have lost eggs or chicks remain in the estuary and use East Sand Island for roosting; so recent years when gull predation has had a large impact on terns fledged, smolt consumption has still been high. The result of no gull predation and large numbers of terns fledged would, however, tend to increase smolt consumption because of greater amounts of food required when raising young. Consumption of juvenile salmonids, however, has been far less than pre-year 2000 when the Caspian tern colony in the estuary was located upriver at Rice Island because of greater species diversity and abundance of marine forage fish lower in the estuary (see Figure 3 also). Yearly consumption of juvenile salmonids by Caspian terns averaged over 10 million when the colony was located at Rice Island and, as mentioned previously, was estimated at 4.7 million in 2013 with the colony at East Sand Island.

It is assumed that the number of Caspian Terns returning to East Sand Island in 2014 would be large enough to occupy the 1.08 acres of nesting habitat at the density observed in 2013. It is also assumed that enough Caspian terns would be present in 2014 to nest at higher densities than observed in 2013; whether or not they would nest at higher densities on East Sand Island than observed in 2013 is unknown; they may since even higher nesting densities of 1.5 per square meter have been observed as mentioned previously. At Crescent Island in the Columbia Plateau Region, Antolos et al. (2006) found that nesting density (within a colony) had no effect on productivity of Caspian terns; mean density was 0.97 pairs per square meter and ranged from 0.25 to 1.48 pairs per square meter. They also found that earlier nesters tended to be more densely packed than later nesters. Cuthbert (1988) showed that Caspian terns on islands in Lake Michigan were less likely to return to a nesting colony if nesting had been unsuccessful the previous year. Recent

low nesting success, and complete failure of the colony in 2011 however, has not deterred Caspian terns from returning to nest at the East Sand Island colony in large numbers.

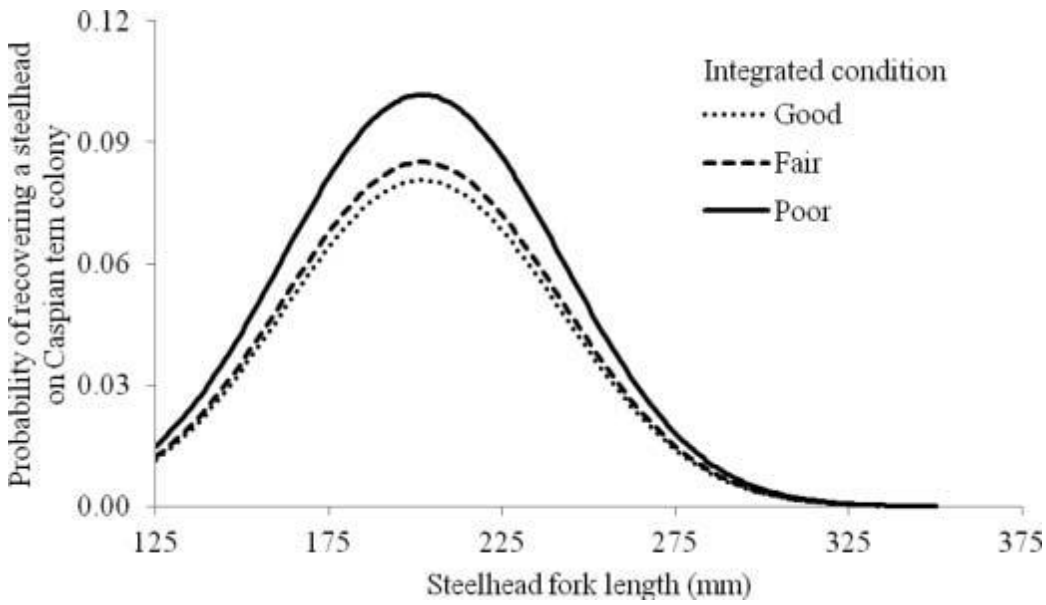

Figure 13. The effect of steelhead size on susceptibility to Caspian tern predation in the vicinity of the confluence of the Columbia and Snake Rivers (Hostetter et al. 2012).

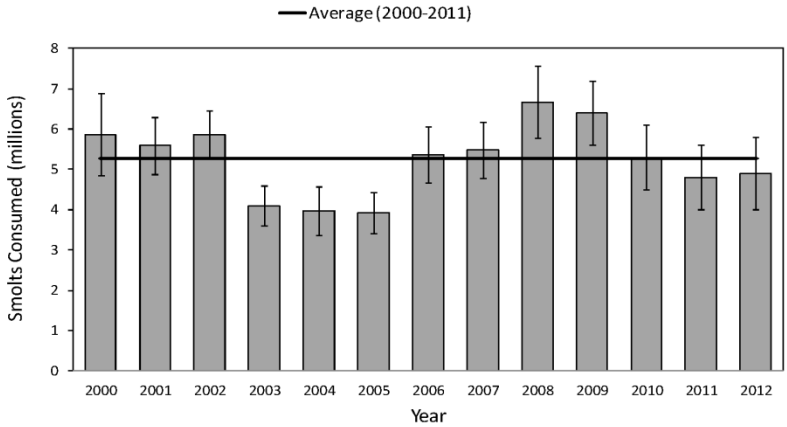

Figure 14. Estimated total annual consumption of smolts (juvenile salmonids) by Caspian terns nesting on East Sand Island in the Columbia River Estuary during the 2000 to 2012 breeding seasons. Estimates are based on fish identified in tern bill loads on-colony and bioenergetics calculations (Roby et al. 2012 Annual Report). Data for 2013 not yet available but estimate was near 4.7 million smolts consumed (Roby et al. 2013). The error bars represent 95% confidence intervals.

The density of Caspian terns nesting on East Sand Island in 2013 was approximately 1.1 nests per square meter resulting in approximately 7,111 nests, the highest density ever observed in the Columbia River Estuary (Roby et al. 2013) (Figure 15). If nesting occurs at this density in 2014 over 1.08 acres, approximately 5,200 nests would result. This is approximately 66% more pairs than the high end of the range identified in the Caspian Tern Plan of 3,125. It is expected that some of the returning Caspian terns that would not be able to nest at the East Sand Island colony because of unavailable space would attempt to nest elsewhere in the Columbia River Estuary as they have done in past years; especially upriver at Rice Island, the main nesting colony site prior to movement of terns to East Sand Island. Terns may also attempt to nest along the eastern shore of East Sand Island as they have done in the past and available habitat toward the western end of the island. Continued dissuasion and hazing, potentially more intense than in the past, where necessary under the Proposed Action of the Draft EA would be expected to alleviate this problem to a large extent; this has been successful during previous years.

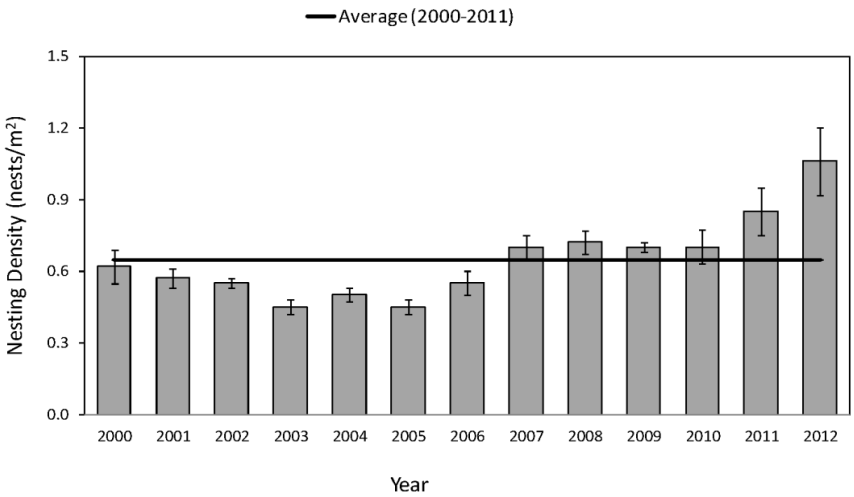

Figure 15. Nesting density of Caspian terns on East Sand Island (Roby et al. 2012 Annual Report). Data for 2013 not yet available, but estimate was near 1.1 per m^2 (Roby et al. 2013). The error bars represent 95% confidence intervals.

Reducing nesting area on East Sand Island prior to the 2014 nesting season likely will not reduce predation on juvenile salmonids in the Columbia River Estuary in 2014. With reduction of the nesting area, predation on juvenile salmonids could, conceivably, increase in 2014 with implementation of the Proposed Action of the Draft EA compared to the No Action Alternative resulting from use of upriver areas of some of the excess terns that would not be able to nest on East Sand Island because of limited space. The diet of terns using upriver areas such as Rice Island, Pillar Rock Island, and Miller Sands Spit would tend to include greater percentages of juvenile salmonids than birds nesting at East Sand Island and foraging closer to the island because of the scarcity of marine forage fish such as anchovy, herring, and smelt at upriver locations; intense predation on juvenile salmonids, as described earlier, was the reason for relocation of the Caspian tern colony from Rice Island to East Sand Island. Non-nesting terns are expected to eat less, however,

than nesting terns that are feeding young; but a non-nesting tern foraging in the vicinity of Rice Island, for example, may consume more juvenile salmonids than a nesting bird at East Sand Island. Roby et al. (2002) showed that the diet of Caspian terns nesting on Rice Island in 1999 and 2000 comprised 77% and 90% juvenile salmonids, respectively. Conversely, diets of Caspian terns nesting on East Sand Island have been, on average since colony establishment, comprised of approximately 31% juvenile salmonids (Roby et al. 2012 Annual Report). Recent hazing efforts have been necessary on Rice Island, as terns have attempted to nest, but not on Pillar Rock Island or Miller Sands Spit (Roby et al. 2012 Annual Report). In 2012, dredged material placed on Miller Sands Spit was contoured to establish mounds to reduce sight distance of terns on the ground and prevent nesting. Use of the upriver islands, however, is not expected to be great.

Based on current re-sighting data for Caspian terns banded on East Sand Island, some if not most of the terns dissuaded from nesting on East Sand Island in 2014 would relocate and attempt to breed at the Corps' constructed tern islands located in interior Oregon and California (Bird Research Northwest 2014).

While the Draft EA was available for public review and since closing of review, severe drought remains at the interior nesting sites. This drought is creating undesirable nesting conditions for terns resulting from "landbridging" of islands where nesting colonies are located, which allows for access and nest predation by a variety of mammals, and by poor foraging conditions created by low water. Failed nesting in the interior would likely result in these terns relocating to the Columbia Plateau Region and/or back to the estuary. There are known cases of banded terns nesting on East Sand Island and interior islands during the same year. The diets of these relocated terns would likely consist of a greater percentage of juvenile salmonids than terns in the vicinity of East Sand Island because of the increased scarcity of marine forage fish with distance upriver. That failed nesters are attracted to East Sand Island was evident with recent failed nesting at Dungeness Spit, caused mainly by predation from coyotes, where approximately 1,000 pairs came to East Sand Island late in the nesting season and attempted to nest on the eastern shore; most were dissuaded but some fledged young late in the season. Reduction of the number of nesting pairs of Caspian terns on East Sand Island and commensurate reduction in predation on Columbia Basin juvenile salmonids does remain the long-term goal, but it has become apparent that 2014 is a particularly poor year to try to "push" terns off of East Sand Island by reducing nesting area.

While a decrease in predation on juvenile salmonids likely would not be realized in 2014 with implementation of the Proposed Action in the Draft EA, the goal of reducing nesting area on East Sand Island is long term maintenance of the Caspian tern population in the Columbia River Estuary in order to benefit ESA-listed salmonids, and was identified in the Draft EA as a corrective measure to account for unexpectedly high nesting density on East Sand Island. Greater concentrations of breeding Caspian terns in response to anthropogenic factors (e.g. habitat creation) is an important conservation concern for this species (Suryan et al. 2004). This corrective measure was identified in the Draft EA as needed to address the guiding principles identified in the Caspian Tern Plan, specifically points three and five: "Management actions will be implemented to ensure terns remain a

viable and integral part of the estuarine, coastal, and interior ecosystems of the Pacific Coast region, including the Columbia River Estuary, in a manner consistent with salmon recovery" (point three); and "Management actions will be implemented to ensure the recovery of ESA-listed salmonids is not impeded by tern predation" (point five). Implementation of the Proposed Action of the Draft EA is predicted to have benefits to ESA-listed salmonids in the long term by reducing predation from Caspian terns by lowering adjusting the East Sand Island Caspian tern colony size and producing less young that could return to the estuary, but would likely not have benefits in this regard during 2014. This change in nesting area would be in response to unexpected high nesting densities, to an area aimed to address management objectives with respect to numbers of nesting terns, while acknowledging that compensation for Caspian tern nesting habitat loss by providing habitat elsewhere would not occur immediately.

Pacific eulachon, a species of smelt and often referred to as "smelt", migrate upriver in the Columbia River to their spawning areas mainly in the Lewis and Cowlitz Rivers of Washington and the Sandy River of Oregon. Eulachon are similar to most salmonids in that they are semelparous, dying after spawning, so any concern with respect to predation from Caspian terns would be with fish that are moving upriver. Out-migrating eulachon occur in the larval stage and drift through the Columbia River Estuary typically during spring and would not be susceptible to predation from Caspian terns because of their small size. Eulachon are the only other ESA-listed species besides salmonids that Caspian terns in the lower Columbia River could potentially impact. Eulachon migrate close to the water surface in schools and these schools are often followed by predatory birds, especially gulls, as they move upriver.

Abundance of migrating adult eulachon in the Columbia River has historically been highly variable (Figure 16). The 2012 ESA listing of the species was in response to low numbers beginning in the early 1990s, but 2013 resulted in a strong run. Caspian terns typically arrive at Oregon colonies in late March and early April (Roby et al. 2003). Freshwater entry of eulachon from the Pacific Ocean and migration through the Columbia River Estuary typically occurs for the most part before Caspian terns would arrive in the Columbia River Estuary (Figure 17); during most years, it would be expected that there would be no Caspian tern predation on eulachon. Entry into freshwater appears to be mainly dependent on water temperature with upriver migration typically occurring during winter, often in early to mid-January (ODFW and WDFW 2009).

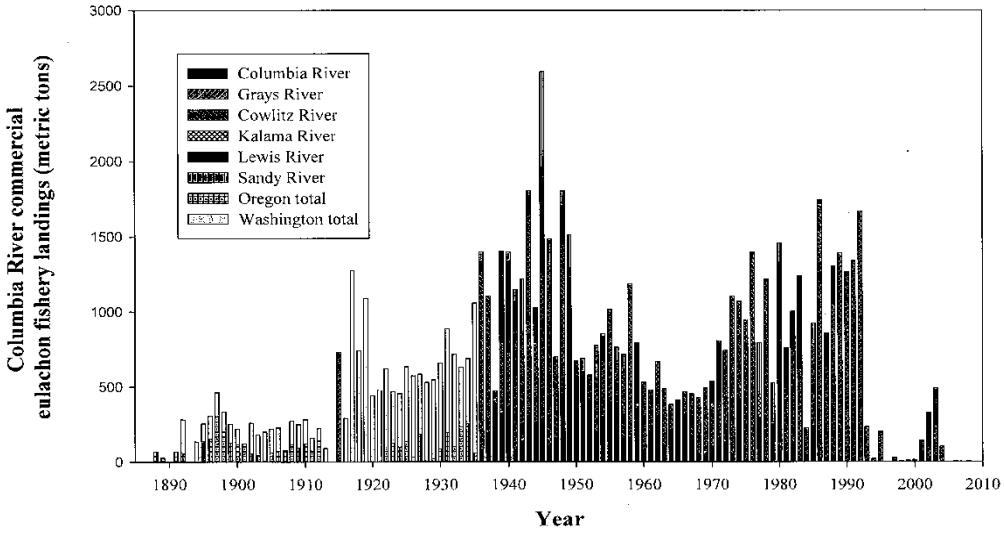

Figure 16. Eulachon commercial catch, an indicator of relative abundance among years, in the Columbia River Basin (NMFS 2010).

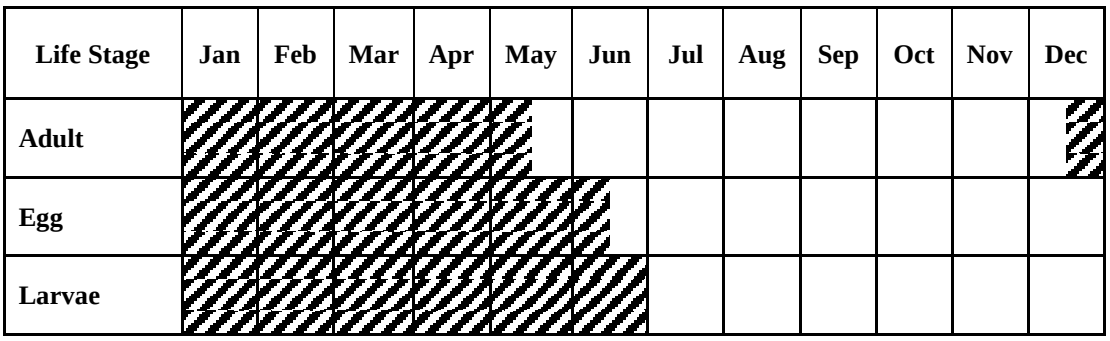

Figure 17. Pacific eulachon presence by life stage in the lower Columbia River (Corps et al. 2013). Presence of adults during spring, however, is rare.

Adult eulachon are usually of appropriate size to be taken by Caspian terns. In San Francisco Bay, Caspian terns fed exclusively on fish that were 8 to 23 cm (80 to 230 mm) in length (Roby and Collis unpublished data cited in Strong et al. 2003) and in the Columbia River predation susceptibility peaked at 20.2 cm (202 mm) (Figure 13); adult eulachon range in size from 14 to 30 cm (140 to 300 mm) (Hart and McHugh 1944).

Caspian terns in the Columbia River Estuary could conceivably prey upon eulachon during years when eulachon entry into the Columbia River occurs later than typical. Migratory timing of eulachon and arrival of Caspian terns in the Columbia River Estuary, however, typically do not overlap. Of the very large number of observations made on fish taken by Caspian terns over the years in the Columbia River Estuary, eulachon have not been detected in their diet (Bird Research Northwest 2014). Implementation of the Proposed Action of the Draft EA would tend to reduce the number of Caspian terns in the Columbia River Estuary but, since predation on eulachon has not been documented, there

is no reason to believe that reducing the number of Caspian terns in the estuary would benefit eulachon, but reduction certainly wouldn't have any negative effects.

Reduction in nesting area on East Sand Island is expected to result in movement in future years of some terns that would have returned to East Sand Island. In 2013, approximately 680 Caspian terns moved from East Sand Island to some of the constructed inland sites, including Summer Lake, Malheur Lake, Crump Lake, Sheepy Lake, and Tule Lake (Roby et al. 2013). Based on banding data, it is thought that Caspian terns that are not actively nesting (either have not started nesting, have finished nesting, or have failed nesting) are free to move around within the year. Wandering probably plays an important role in assessing other nesting and foraging opportunities. Since Caspian terns are long-lived and have evolved with ephemeral nesting habitat, wandering to other areas is probably advantageous (communication with Donald E. Lyons, OSU, January 9, 2014). As described earlier, the Caspian Tern Plan called for redistribution of approximately 60% of the East Sand Island colony population via construction of new habitat (islands) in Oregon, California, and Washington. Additional movement of Caspian terns out of the Columbia River Estuary to these inland locations in future years will aid in Columbia Basin salmonid recovery because these stocks of course do not occur at the inland lake locations.

Food habits of Caspian terns at the inland locations include crappie (including white crappie) , bass, catfish, chub (including Tui chub), minnows, carp, rainbow trout, Sacramento perch, and Klamath largescale sucker, none of which are ESA-listed. Predation on ESA-listed species is not too much of a concern at the inland locations; the only ESA-listed species observed to be preyed upon by Caspian terns was an individual Warner sucker at Crump Lake in 2008 (Roby et al. 2012 Annual Report).

Streaked horned larks, a subspecies of the widely distributed horned lark, occurs west of the Cascade Range including in the Columbia River Estuary and was listed under ESA in 2013. Although there is anecdotal evidence of streaked horned larks occurring on East Sand Island, no nesting has been observed. Reduction of Caspian tern nesting habitat acreage in 2014 in combination with dissuasion/hazing on East Sand Island could conceivably result in more terns moving upriver in the Columbia River Estuary which may result in more prospecting and a greater chance that terns would attempt to nest on Rice Island, Miller Sands Spit, and Pillar Rock Island. Dissuasion and hazing on these islands is a requirement of the NMFS 2012 Biological Opinion and occurs annually. Recent surveys have documented nesting of streaked horned larks at Rice Island, Miller Sands Spit, and Pillar Rock Island (Pearson and Altman 2005; Anderson 2009); no nesting has been reported from East Sand Island. Streaked horned larks also winter on islands in the lower Columbia River.

Streaked horned larks are known to nest in areas of dredged disposed material but not newly placed material; they typically use areas with substantial areas of bare ground with sparse, low growing vegetation composed primarily of grasses and forbs (Federal Register 2013a; Pearson and Hopey 2005), which is different than Caspian terns which prefer bare sand or very sparsely vegetated sand. Therefore, there is not an expectation

that streaked horned larks and Caspian terns would use the same areas for nesting. The Corps is currently consulting with USFWS on the effects of navigation channel operations and maintenance on streaked horned lark (Corps 2014a), which includes dredged material (sand) disposal on Rice Island, Miller Sands Spit, and Pillar Rock Island.

The nesting season for streaked horned larks begins in early April and ends mid to late August, very similar to the nesting season of Caspian terns. Clutches range from one to five eggs, with a average of three. After the first nesting attempt in April, streaked horned larks will often re-nest in late June or early July (Pearson and Hopey 2004 and 2005; Moore 2011). Young streaked horned larks leave the nest by the end of the first week after hatching, and are cared for by the parents until they are about four weeks old when they become independent (Beason 1995). Dissuasion and hazing that will likely be necessary to prevent Caspian terns from nesting at the island sites would overlap with streaked horned lark nesting activities; hazing of Caspian terns has only been required on Rice Island, however. The Corps' Biological Assessment (Corps 2014a) proposes to haze, place physical barriers, and modify habitat to prevent nesting of Caspian terns and streaked horned larks in areas slated for dredged material disposal as required by NMFS, as mentioned above.

The Corps 2014 Biological Assessment and the NMFS 2012 Biological Opinion, make no estimates of how many Caspian terns may need to be dissuaded, and it is unpredictable as to how many additional terns might try to nest on these islands resulting from implementation of the preferred alternative of reducing nesting habitat acreage on East Sand Island. It is predicted that based on current re-sighting data for Caspian terns banded on East Sand Island, some if not most of the terns dissuaded from nesting on East Sand Island in 2014 would relocate and attempt to breed at the Corps-constructed tern islands located in the interior of Oregon and California. And it is unlikely that large numbers of Caspian terns that can't find space to nest at East Sand Island would instead remain near Rice Island/Miller Sands Spit for the entire smolt out-migration (Bird Research Northwest 2014).

The 2014 Corps' Biological Assessment made an effect determination of May Affect, Likely to Adversely Affect for operation and maintenance activities on streaked horned lark. This was for all actions combined including placement of dredged material, however, not specifically hazing of Caspian terns. As mentioned above, Caspian terns prefer bare sand areas for nesting while streaked horned larks prefer sandy areas that are upland and sparsely vegetated. Streaked horned larks walk through vegetation as opposed to hopping; consequently denser vegetation can be difficult to traverse (Beason 1995).

Extensive studies on nesting of streaked horned larks, including in the Columbia River Estuary, were conducted by Pearson and Hopey (2004; 2005). On island in the Columbia River Estuary, they found that females selected nest sites with fewer non-vegetated areas, more thatch and perennial forbs, and shorter vegetation than nearby non-use sites. Successful nest sites contained more annual grasses, more perennial forbs, less rock, and shorter vegetation than unsuccessful nests. Nearly all nests examined by Pearson and

Hopey (2004; 2005) were located at the base of a grass or forb; 89% on the northerly side of plants; this orientation likely chosen to increase shading of the nest (Hartman and Oring 2003). On the Columbia River islands, use of the point intercept method (e.g. Bonham 1989) by Pearson and Hopey (2004; 2005) yielded contact with vegetation at nearly every sample location within streaked horned lark nest sites and territories. The Primary Constituent Elements (PCEs) detailed in the ESA listing of streaked horned lark and their critical habitat (Federal Register 2013b) includes a minimum of 16% bare ground that has sparse, low-stature vegetation composed primarily of grasses and forbs less than 13 inches in height found in (1) large (300-acre), flat (0 to 5% slope) areas within a landscape context that provides visual access to open areas such as open water or fields, or (2) areas smaller than described in (1), but that provide visual access to open areas such as open water or fields. All of the units designated as critical habitat are currently occupied by the streaked horned lark and contain the primary constituent elements to support the life history needs of the streaked horned lark. Rice Island, Miller Sands Spit, and Pillar Rock Island are all included as designated critical habitat, although the PCEs are not present at various locations on each island.

Past observations of the three islands have shown that Caspian terns do not show an interest in these upland areas where streaked horned larks would be likely to nest. Of the three upriver islands, only Rice Island has required hazing of Caspian terns, and this has been done in low lying areas of bare sand or nearly bare sand in areas where streaked horned larks would not be expected to nest or use post-nesting. No hazing of Caspian terns on Rice Island was required in 2013, and decrease in nesting acreage in the past does not appear to have resulted in increased numbers of Caspian terns at Rice Island (Corps 2014b). As a management recommendation, Pearson and Hopey (2004; 2005) recommended that most human activities within 30 m of breeding streaked horned larks be limited, and noted that activities that prevent females from returning to their nests for extended periods of time may cause nest abandonment. They also noted that larks are more likely to flush in response to pedestrian activity than vehicle activity. During the non-nesting season, streaked horned larks use habitat that is very similar to their nesting habitat (Pearson et al. 2005). Overlap of streaked horned larks and Caspian terns is not expected and it is not expected that dissuasion of Caspian terns would occur within 30 m of streaked horned lark nests, and therefore any required dissuasion of Caspian terns is not expected to adversely affect nesting streaked horned larks or larks using nearby areas.

Dissuasion and hazing at Rice Island has been funded by the Corps Portland District Columbia River Operations and Maintenance program, and will continue. The Corps is currently preparing a Biological Assessment for continued maintenance dredging and disposal of dredged material (including on Rice Island, Miller Sands Spit, and Pillar Rock Island). Preparation of this Biological Assessment was necessitated by the ESA listing of the streaked horned lark.

No Action Alternative:

Impacts on streaked horned larks with the No Action alternative are predicted to be the same as with the Proposed Action of the Draft EA because of lack of overlap of terns and streaked horned larks on the upriver islands.

Because of run timing of eulachon and because none have been observed in the Caspian tern diet, the No Action alternative is predicted to have no effects on eulachon as described for the Proposed Action of the Draft EA.

Keeping the East Sand Island Caspian tern colony size at 1.58 acres would allow for more nesting terns than is desired. The Caspian Tern Plan targeted 3,125 to 4,375 nesting pairs on East Sand Island for an area of 1.5 to 2 acres of nesting area (with a final goal of 2,500 to 3,125 nesting pairs). As noted earlier, acreages of nesting habitat were established based on predicted nesting density, but densities on East Sand Island have been higher than expected; approximately 7,111 nesting pairs were present on the island in 2013. Reduction of the number of nesting pairs on East Sand Island and commensurate reduction in predation on Columbia Basin juvenile salmonids, however, does remain the long-term goal. For 2014 specifically, the No Action is predicted to have less impacts on juvenile salmonids than the Proposed Action of the Draft EA. Drought conditions in the interior in 2014, as described above, are creating undesirable nesting conditions for terns resulting from "landbridging" of islands where nesting colonies are located, which allows for access and nest predation by a variety of mammals, and by poor foraging conditions created by low water. Failed nesting in the interior would likely result in these terns relocating to the Columbia Plateau Region and/or back to the estuary. The diets of these relocated terns would likely consist of a greater percentage of juvenile salmonids than terns in the vicinity of East Sand Island because of the increased scarcity of marine forage fish with distance upriver. Through the NEPA process, it has become clear that year 2014 is a particularly poor year to "push" terns off of East Sand Island. Benefits will be realized from "keeping" terns in the lower Columbia River Estuary during 2014.

Fish and Wildlife (non-ESA-listed):

Proposed Action of the Draft EA: Implementation of the Proposed Action was considered in the Draft EA as a corrective measure to prevent the potential for undesired population expansion of Caspian terns in the Columbia River Estuary, and resultant increased predation on juvenile ESA-listed salmonids; although as described above, year 2014 is a particularly poor year to "push" terns off of East Sand Island. Non-ESA-listed fish species upon which Caspian terns prey in the lower Columbia River Estuary in the vicinity of East Sand Island and the ocean include anchovy, herring, surfperch, Pacific sand lance, and smelt. Longfin smelt and surf smelt are present in the estuary throughout the Caspian tern nesting season; Bottom et al. (1984) found that longfin smelt and surf smelt were represented in the estuary consistently during spring high and summer low flow periods. With implementation of the Proposed Action of the Draft EA, the aim would be to stabilize the Caspian tern nesting population in future years. This would tend to lessen predation on non-ESA-listed fish in the long term compared to the No Action

Alternative, which would allow more nesters on East Sand Island. However, Caspian tern predation on non-ESA-listed fish in the Columbia River Estuary, primarily marine forage fish, is not a concern from the standpoint of the health of those populations.

Bald eagles and Calfornia brown pelicans are both piscivorous and were both formerly listed under ESA; bald eagles being delisted in 2007 and California brown pelicans in 2009. Bald eagles nest and are permanent residents in the Columbia River estuary. They prey primarily upon waterfowl and large fish, and frequently scavenge (Isaacs and Anthony 2003). The size of fish they take are larger than Caspian tern prey so any increases in number of juvenile salmonids and/or other forage fish in the Columbia River Estuary that result from implementation of the Proposed Action of the Draft EA would have no impact on the prey base for bald eagles. There are known instances of bald eagles attempting to pirate small fish from Caspian terns (e.g. Scientific Resources Inc., 1990), but these apparently are uncommon occurrences.

California brown pelicans have become common in the Columbia River Estuary and East Sand Island has been, during some if not all years since 2002, the largest night time roost for this species on the Pacific Coast with thousands present (Figure 18). Approximately 16,000 California brown pelicans were present in 2009, which is the peak year so far (Bird Research Northwest 2014b). An estimate of 22,000 pelicans on East Sand Island was also made on a one day survey in 2009 (communication with Deborah Jaques, 2013). Wright et al. (2007) reported that less than 100 birds occurred on the island annually from 1979 to 1986. California brown pelicans typically arrive in the Columbia River Estuary in early May and numbers peak in August (Wright et al. 2007), but they have been arriving earlier and have been seen in March recently (Roby et al. 2012). California brown pelicans are not deterred from roosting in areas where dissuasion material has been placed; up to 1,500 individuals roosted in cormorant dissuasion areas near the west end of East Sand Island in 2012 (Roby et al. 2012).

Wright et al. (2007) showed that land-based human disturbance was negatively associated with total roosting California brown pelican numbers, while water-based human disturbance was not. Dissuasion materials have the potential to cause continued entanglement of California brown pelicans. Dissuasion will involve installation of a perimeter of 5 ½ inch metal T-posts with interior metal U-posts at least four feet tall and connected by yellow poly rope with 4-mil flagging (yellow caution tape or similar) secured to the rope at the mid-point between stakes (Corps 2014e). Stakes will be placed a minimum of ten feet apart. One flag is required per each mid-point between stakes and will have a length after tying of a minimum to two feet. Poly rope will be a minimum of ¼ inch in diameter. When complete, the dissuasion will have the appearance of a grid pattern. After the nesting season, dissuasion materials will be stored in non-vegetated upland areas near the colony and on the western end of the island and near the eastern shore in close proximity to the three areas where dissuasion will occur. Rope will be stored in spools and not pose a threat of entanglement of pelicans.

Prior to the nesting season, dissuasion material will be placed from March 21 to April 15 on the eastern shore of East Sand Island (over approximately three acres) and at the

western end of the island near the double-crested cormorant colony (over approximately two acres). An additional area (perhaps as much as 1.5 acres) along the eastern shore may require dissuasion because of dropping river during summer levels and exposure of suitable nesting habitat along the eastern shore. The acreage of dissuasion along the eastern shore will be similar to what has been done in the past. The western area has not been dissuaded before. Two California brown pelicans were documented as becoming entangled in dissuasion material on East Sand Island; one in 2011 and one in 2013. Both were disentangled and released, apparently unharmed (communication with Daniel D. Roby, OSU, February 4, 2014). Although this is likely an unusual occurrence, increased dissuasion efforts involving placing more material would pose increased risk for entanglement of pelicans. The expected number of incidents would remain low, however, but the probability of entanglement may be about twice that of previous years because about twice as much area of dissuasion materials will be placed.

California brown pelicans forage on fish of similar size to Caspian tern prey. The availability of forage fish is not believed to be a limiting factor for piscivorous birds in the Columbia River Estuary. California brown pelicans feed primarily on northern anchovy, at least in the California Current system (Anderson and Gress 1982) but are opportunistic feeders (Anderson and Anderson 1976) and feed more during lower tides (Wright et al. 2007). Pacific herring and Pacific sand lance were found to be the most common species taken near Vancouver Island, British Columbia (Burger et al. 1998). These three species of fish often taken by California brown pelicans are typically similar in size to juvenile salmonids in the Columbia River Basin; northern anchovy (~17.8 cm, 178 mm), Pacific herring (~25 cm, 250 mm), and Pacific sand lance (~20 cm, 200 mm) (Hart 1973). California brown pelicans often take multiple fish on single dives into the water from flight and tend to concentrate on schools of fish. Therefore, it is unlikely that California brown pelicans prey heavily on juvenile salmonids when occupying East Sand Island, and PIT tag (passive internal transponder) data from Roby et al. (2012) indicates that California brown pelicans using East Sand Island are not feeding on juvenile salmonids.

Gulls, in general, have a varied diet (e.g. Marshall et al. 2003) and are not considered a problem with predation on juvenile salmonids in the Columbia River Estuary. Reducing the acreage of prepared habitat and allowing encroachment of vegetation over time could possibly benefit ring-billed gulls; Hayward (1993) showed that ring-billed gulls in Washington had better nesting success when nests were located in tall grass. Ring-billed gulls have not nested within the Caspian tern colony on East Sand Island (Bird Research Northwest 2014). Recently a colony of about 1,700 ring-billed gulls has become established on the eastern shore of East Sand Island. Reducing the East Sand Island Caspian tern colony acreage by implementation of the Proposed Action of the Draft EA would not impact ring-billed gulls. Ring-billed gulls are common and have a broad distribution in North America (Butler 2003) and do not garner much management concern. Hybrid gulls have nested in low numbers (perhaps a few dozen) within the tern colony (Bird Research Northwest 2014) but there is no conservation concern with respect to hybrid gulls.

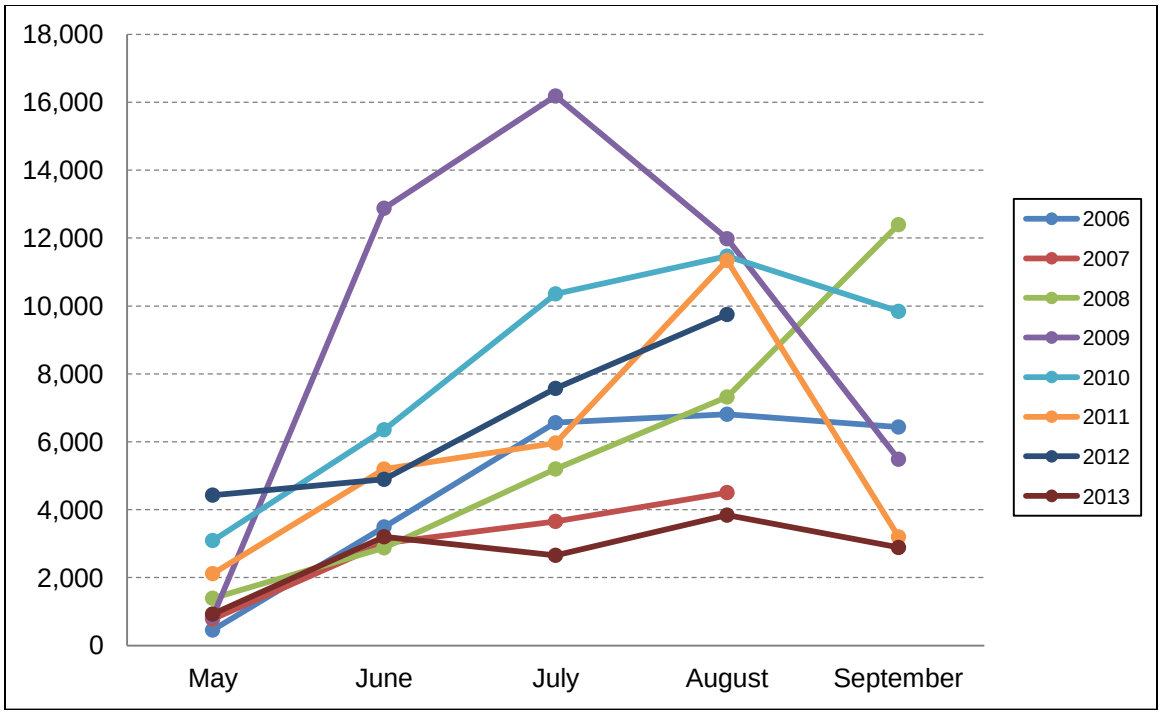

Figure 18. Monthly average number of California brown pelicans roosting on East Sand Island during evening surveys conducted from 2006 through 2013 (Bird Research Northwest 2014b). Highest numbers recorded were in 2009 and lowest numbers in 2013. Numbers of pelicans generally increased from year 2007 to 2009, then decreased to 2013.

Reducing acreage would not impact nesting of double-crested and Brandt's cormorants as these two species nest on the other side (west side) of East Sand Island and are separated from the Caspian tern colony by dense shrubbery. While Caspian terns have attempted to nest on East Sand Island outside of the designated colony, this has been done on the east shore of the island (near the Caspian tern colony). There is potential Caspian tern nesting habitat (about two acres) near the west end of the island near the cormorant colony, which will be completely dissuaded in 2014.

No Action Alternative: With the No Action Alternative, maintaining 1.58 acres of nesting habitat on East Sand Island in 2014 would tend to "keep" Caspian terns in the lower Columbia River Estuary. Less terns would be expected to move to the upriver islands of Rice, Miller Sands, and Pillar Rock. Less would also be expected to move to the interior nesting sites. Drought conditions in the interior in 2014 are creating undesirable nesting conditions for terns resulting from "landbridging" of islands where nesting colonies are located, which allows for access and nest predation by a variety of mammals, and by poor foraging conditions created by low water. With implementation of the No Action, less terns would be expected to occupy the interior areas. Failed nesting in the interior would likely result in these terns relocating to the Columbia Plateau Region and/or back to the estuary. The diets of these relocated terns would likely consist of a greater percentage of juvenile salmonids than terns in the vicinity of East Sand Island because of the increased scarcity of marine forage fish with distance upriver. For these

reasons, the No Action for 2014 is desirable in an effort to "keep" more terns in the lower estuary where juvenile salmonids represent less of a percentage of the diet than farther upriver. Reduction of the number of nesting pairs on East Sand Island and commensurate reduction in predation on Columbia Basin juvenile salmonids, however, does remain the long-term goal.

Potential effects from dissuasion on California brown pelicans for the No Action are as described for the Proposed Action of the Draft EA because the same amount of dissuasion material is planned for East Sand Island under both alternatives.

Vegetation:

Proposed Action of the Draft EA: With implementation of the Proposed Action, vegetation would be allowed to grow back within the 0.5 acre of area that would be removed from the Caspian tern nesting area on East Sand Island. It would take about three years to fully revegetate. This vegetation would consist mostly of non-native American dunegrass and European beachgrass, and would prevent nesting of Caspian terns.

No Action Alternative: With the No Action Alternative, vegetation on East Sand Island would continue to be maintained, with 1.58 acres being disked annually to support nesting of Caspian terns.

Wetlands:

***Proposed Action of the Draft EA*:** Jurisdictional wetlands occur on East Sand Island (Figure 19). No disturbance to wetlands on East Sand Island will result from the work. ATV use for hauling dissuasion materials, disking, etc. will be confined to uplands.

***No Action*:** No disturbance to wetlands on East Sand Island will result from the work. ATV use for hauling dissuasion materials, disking, etc. will be confined to uplands.

Ground Disturbance:

Proposed Action of the Draft EA: With implementation of the Proposed Action, the area removed from the nesting acreage (0.5 acre of previously disposed dredged material) would no longer be disked.

No Action Alternative: No changes to ground disturbance would result from the No Action Alternative. The entire current Caspian tern nesting area (1.58 acres of previously disposed dredged material) on East Sand Island would continue to be disked annually before nesting begins in March.

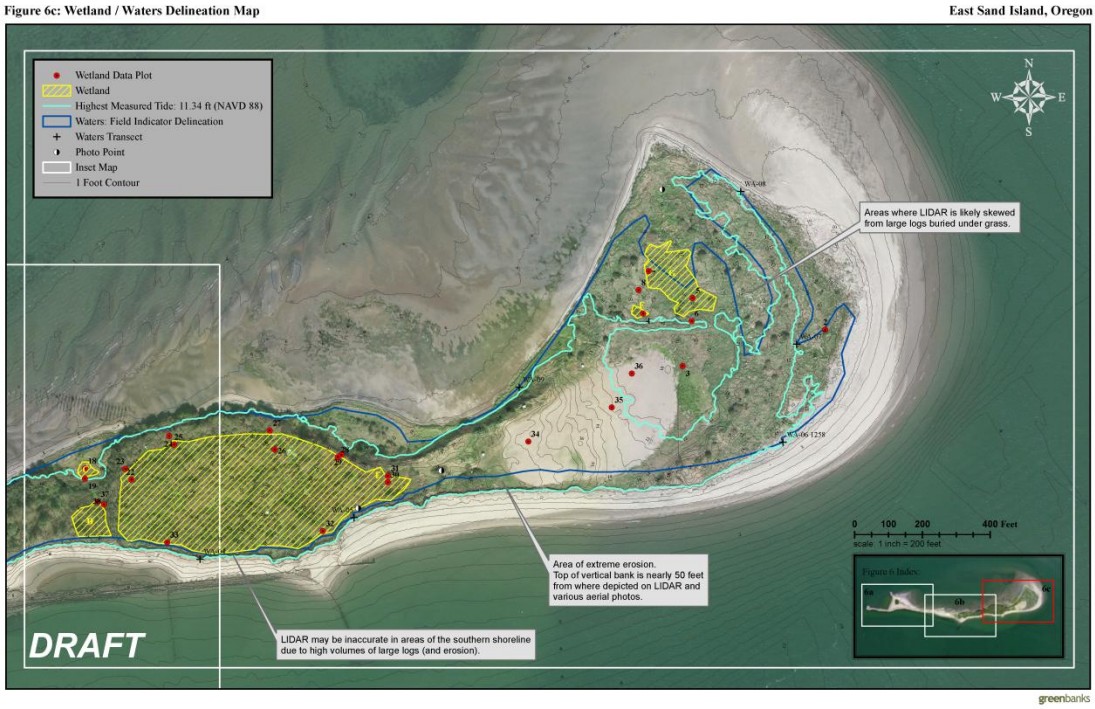

Figure 19. The eastern portion of East Sand Island showing the wetlands occurring on the island (in yellow), on either side of the Caspian tern colony.

Cultural Resources:

Proposed Action of the Draft EA:

Two sites on East Sand Island were determined eligible for listing on the National Register of Historic Places and three sites were determined not eligible. All sites will be avoided.

The Corps has determined that the Proposed Action would result in 'no historic properties affected.' Annual ground disturbance would cease over 0.5 acre of the current East Sand Island Caspian tern nesting colony, which is located on previously placed dredged material. Dissuasion material may be placed on the east shore of the island as in years past and near the west end of the island; this area however is low-lying and subject to erosion/deposition and not expected to yield cultural resources. A pedestrian cultural resource survey occurred during January, 2014. The Corps would coordinate with the Oregon State Historic Preservation Office (SHPO) until concurrence is obtained.

No Action Alternative:

Two sites on East Sand Island were determined eligible for listing on the National Register of Historic Places and three sites were determined not eligible. All sites will be avoided.

The Corps has determined that the No Action would result in 'no historic properties affected.' Annual ground disturbance would continue over 1.58 acres of the current East Sand Island Caspian tern nesting colony which, as noted above, is located on previously placed dredged material. Dissuasion material may be placed on the east shore of the island as in years past and near the west end of the island; this area however is low-lying and subject to erosion/deposition and not expected to yield cultural resources. A pedestrian cultural resource survey occurred during January, 2014. The Corps would coordinate with Oregon SHPO until concurrence is obtained.

Land Use:

Proposed Action of the Draft EA: With implementation of the Proposed Action, 0.5 acre of previously disposed dredged material on East Sand Island would be allowed to revegetate and would not be used by Caspian terns for future nesting.

No Action Alternative: No changes to land use would result from the No Action Alternative. A total of 1.58 acres of nesting habitat (previously disposed dredged material) for Caspian terns would remain available on East Sand Island.

Environmental Justice:

Proposed Action of the Draft EA: Implementation of the Proposed Action would not adversely affect any particular group of people to a greater extent than other groups, as all work would occur on public land. No private property would be impacted from implementation of the Proposed Action.

No Action Alternative: No changes regarding environmental justice would result from the No Action Alternative. There are no issues with environmental justice with management for Caspian terns on East Sand Island.

Recreation:

Proposed Action of the Draft EA: Managed recreation doesn't occur on East Sand Island. Occasional boaters and fishers may use the island. Implementation of the Proposed Action would not impact any recreation that might occur on the island.

No Action Alternative: Managed recreation doesn't occur on East Sand Island. Occasional boaters and fishers may use the island. The No Action Alternative would not impact any recreation that might occur on the island.

CHAPTER 6
CUMULATIVE EFFECTS

Cumulative effects are caused by the aggregate of past, present, and reasonably foreseeable future actions (Bass et al. 2001). This EA considers the contributions of these actions, combined with the Proposed Action of the Draft EA and with the No Action Alternative, on cumulative effects to the natural resources that could affect the quality of the human environment. The area of consideration is the Columbia River Estuary (from the downstream end of Puget Island to the ocean and the interior constructed Caspian tern nesting sites).

Actions considered in the context of cumulative effects in this EA include the following:

- Past Actions: Lethal take of glaucous-winged x western gull hybrids.

- Present Actions: Dissuasion and hazing in the Columbia River Estuary (on Rice Island, Miller Sands Spit, and Pillar Rock Island) as needed; management of interior Caspian tern nesting locations; reduction in nesting habitat in the Columbia River Estuary; and management of Caspian terns in the Columbia Plateau Region by the Walla Walla District.

- Reasonably Foreseeable Future Actions: Reduction in numbers of nesting pairs of double-crested cormorants on East Sand Island; management of Caspian terns in the Columbia Plateau Region; and creation or enhancement of Caspian tern nesting habitat at Don Edwards National Wildlife Refuge in south San Francisco Bay, California.

Proposed Action of the Draft EA

Lethal take of glaucous-winged x western gull hybrids: Glaucous-winged x western gull hybrids have been responsible for Caspian tern egg predation on the colony since 2010; this occurs after bald eagles flush adult terns off their nests. Complete nesting failure occurred in 2011 and was attributable to eagles and gulls. Elimination of 50 of these hybrid gulls in 2013 will tend to lessen the threat of egg predation in 2014, but the lethal take involved a rather small portion of that gull population, approximately 5,000 that has developed over the past 25 years, so benefits are not predicted to be large and the threat of egg take remains. This threat is largely dependent on the presence of bald eagles.

Dissuasion and hazing in the Columbia River Estuary as needed: Implementation of the Proposed Action may result in more Caspian terns going to the upstream islands of Rice, Miller Sands, and Pillar Rock compared to the No Action. Of the three islands, Rice Island has the most potential for nesting Caspian terns. Dissuasion and hazing may be more intense under the Proposed Action, but since streaked horned larks and Caspian terns use different habitats and have not been shown in the past to overlap on these islands, there is very little concern over potential impacts to nesting streaked horned larks.

Management of inland Caspian tern nesting locations: On-going predator management will aid in fledging production of Caspian terns nesting at the interior sites in Oregon and California. Due to drought conditions resulting in land-bridging and low water at some sites, mammalian predation is more of a threat. Predator control will be more difficult in 2014, but may not be required at some nesting locations because of conditions that may prevent nesting in the first place. With the Proposed Action of the Draft EA, more terns would be expected at the interior sites compared to the No Action. Failed nesting because of "land-bridging" and low water at some sites discussed earlier is a strong potential.

Management of Caspian terns in the Columbia Plateau Region: Management actions planned by the Walla Walla District in the Columbia Plateau Region are detailed in Table 2. The year 2014 action (and future years) of completely dissuading Goose Island will result in approximately 400 pairs of Caspian terns looking for alternative nesting sites. This could lead to extra birds at the interior sites and at East Sand Island or the upstream islands in the Columbia River Estuary. The diet of Caspian terns nesting in the Columbia Plateau Region consists primarily of salmonids. If Goose Island terns move to the Columbia River Estuary as a result of dissuasion on Goose Island, it would be expected that less juvenile salmonids would be consumed by Caspian terns in the Columbia River Basin in 2014. Birds that nest in the interior locations, of course, would take no Columbia Basin salmonids there, but because of drought conditions may relocated back to the Columbia Plateau or the estuary.

Table 2. Planned actions and implementation timeline of the Inland Avian Management Plan, Walla Walla District (Corps 2014d). Note (X) indicates implementation only if warranted.

Action	2014	2015	2016	2017	2018
Goose Island: Passive and active hazing of Caspian terns and gulls and, if needed, limited Caspian tern egg take.	X	X	X	(X)	(X)
Crescent Island: Passive and active hazing of Caspian terns and gulls and limited Caspian tern egg take.		(X)	(X)		
Crescent Island: Willows will be experimentally planted to evaluate survival.	X				
At-risk Islands: Dissuasion actions where there is a high risk for incipient Caspian terns to establish.		(X)	(X)		
Habitat Enhancement Sites: Research and NEPA analysis to be completed.	X	(X)			
Habitat Enhancement Sites: Habitat will be prepared to attract Caspian tern nesting.			X		
Goose Island: Modification of substrate by adding large rubble to further dissuade nesting of Caspian terns.				(X)	(X)
Crescent Island: Passive hazing involving planting vegetation and/or placement of a berm. Also, as necessary, active hazing of Caspian terns and gulls and limited egg take.				X	(X)
At-risk Islands: Caspian tern dissuasion.				(X)	(X)

Reduction in nesting pairs of double-crested cormorants on East Sand Island: Nesting by double-crested cormorants on East Sand Island was first recorded in 1989, when 90 active nests were detected at the western tip of the island; since then the colony has grown to over 13,000 breeding pairs. Amidst the double-crested cormorant colony, a colony of over 1,000 Brandt's cormorants has developed.

An EIS is currently being prepared by the Corps for management of cormorants on East Sand Island, with the intent of reducing the number of cormorant nesters in order to benefit Columbia River Basin salmonid populations. On East Sand Island, double-crested cormorants nest in larger numbers and consume more juvenile salmonids than do Caspian terns. Unlike Caspian terns, cormorants are not susceptible to huge nesting failure resulting from disruption of the colony by bald eagles and hybrid gulls. Double-crested cormorants have averaged over 10,000 nesting pairs on East Sand Island since 1997 (Figure 20) and have consumed over 18 million juvenile salmonids during recent nesting seasons (Figure 21).

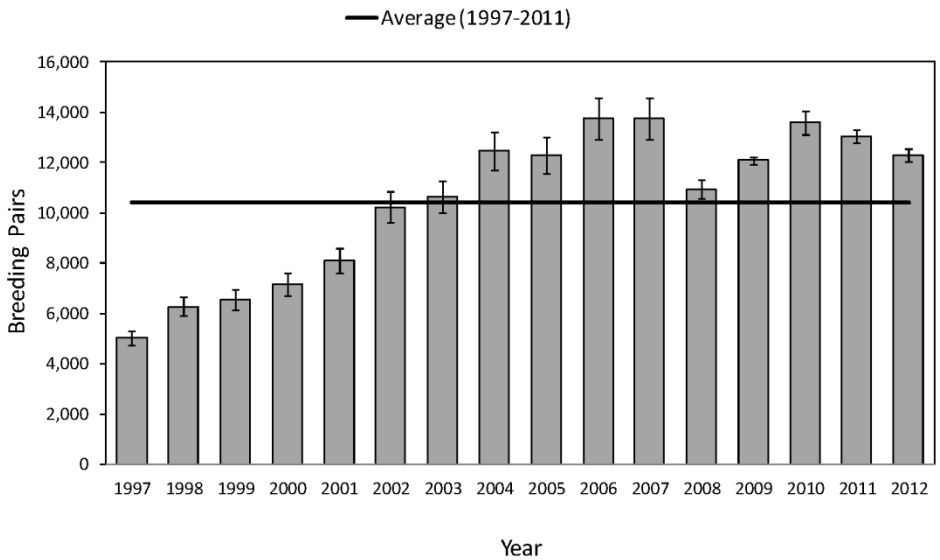

Figure 20. Number of breeding pairs of double-crested cormorants on East Sand Island (Roby et al. 2012 Annual Report). Data for 2013 not yet available. The error bars represent 95% confidence intervals.

A noteable difference exists when comparing juvenile salmonid composition in the diets of Caspian terns to double-crested cormorants: Sub-yearling Chinook salmon are prevalent in the diets of double-crested cormorants (Figure 21) but not in the diets of Caspian terns (Figure 12); yearling Chinook salmon are more prevelent than sub-yearlings in the diets of Caspian terns. Although double-crested cormorants are larger than Caspian terns, it could be that cormorants are less size-specific with respect to prey than are Caspian terns and forage on smaller fish moreso than terns. Sub-yearling Chinook salmon tend to be smaller than prey more commonly captured by Caspian terns. Double-crested cormorants dive from a resting position on the water surface and are capable of deep diving, while Caspian terns dive into the water from flight and are only

capable of capturing prey near the water surface. It is uncertain though that the difference in capture of sub-yearling Chinook salmon is attributable to depth of occurrence; Emmett et al. (2004) showed that sub-yearlings were common in surface trawl samples in the Columbia River Plume.

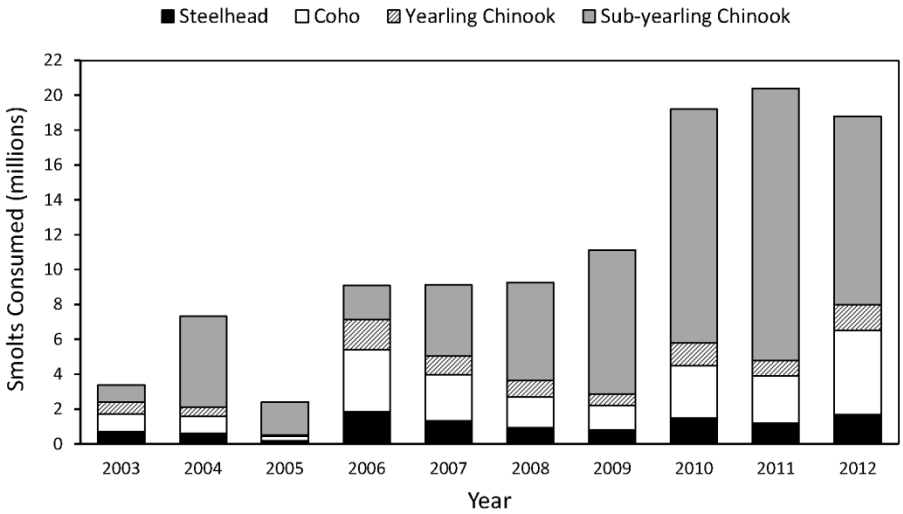

Figure 21. Estimated total annual consumption of steelhead, coho, and Chinook by double-crested cormorants nesting on East Sand Island during the 2003 to 2012 nesting seasons. Estimates based on fish identified in foregut samples and bioenergetics calculations (Roby et al. 2012 Annual Report). Data for 2013 not yet available.

Like Caspian terns, double-crested cormorants utilize a diversity of prey in the Columbia River Estuary (Figure 22) but appear to utilize a more diverse prey base than Caspian terns including minnow, carp, sculpin, flounder (starry flounder is common in the estuary), and stickleback (three-spine stickleback is common in the estuary). This is likely because of the ability of double-crested cormorants to use the entire water column when foraging; they are even able to take benthic species such as flounder and sculpin.

Implementation of the Proposed Action of the Draft EA in conjunction with the reasonably foreseeable future actions of reducing size of the cormorant colony is predicted to result in less avian predation on salmonids in the Columbia River Estuary in future years. Proportions of fish species taken in general (Figures 3 and 22) and for salmonids specifically (Figures 12 and 21) would be expected to remain fairly constant and only fluctuate as relative abundances of fish fluctuate, while numbers taken for each fish species would be expected to decrease proportionately with reduction of numbers of terns and cormorants in the Columbia River Estuary in future years.

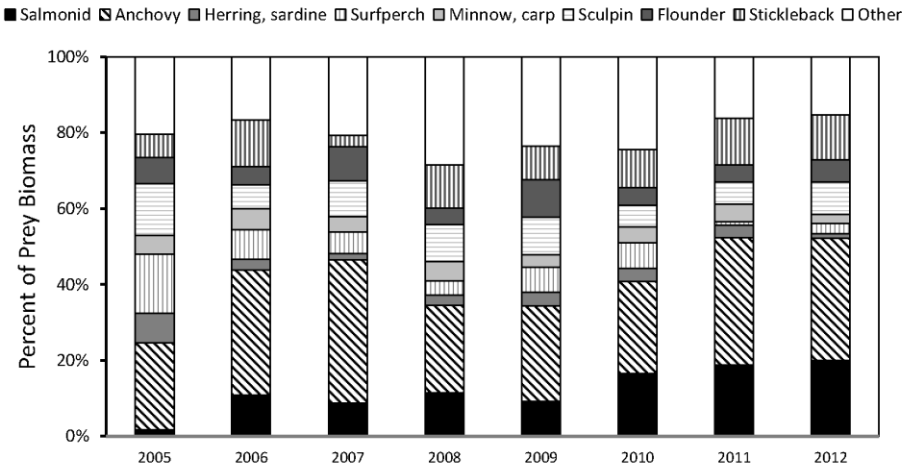

Figure 22. Annual diet composition (percent of prey items) of double-crested cormorants nesting on East Sand Island during 2005 to 2012 nesting seasons based on fish identified in foregut samples (Roby et al. 2012 Annual Report). The varied diet is attributable to the close proximity of East Sand Island to the ocean and the ability of cormorants to forage throughout the water column. Data for 2013 not yet available.

Creation or enhancement of potential Caspian tern nesting habitat at Don Edwards National Wildlife Refuge, south San Francisco Bay: This potential future action is being actively pursued by the Corps in coordination with the resource agencies, USFWS and NMFS. South San Francisco Bay holds good potential for establishment of a coastal site for nesting of Caspian terns because of the abundance of marine forage fish and the scarcity of juvenile salmonids. With respect to predation on ESA-listed juvenile salmonids, south San Francisco Bay is considered a better location than the Columbia River Estuary. Establishment of a Caspian tern colony at this location is predicted to take much of the Caspian tern nesting pressure off of East Sand Island. No nesting sites at Don Edwards would be constructed prior to the 2014 nesting season.

No Action

Lethal take of glaucous-winged x western gull hybrids: Same effects as described above for the Proposed Action of the Draft EA, except that likely more Caspian terns would be on the colony under the No Action than under the Proposed Action, and therefore more terns eggs would be susceptible to predation.

Dissuasion and hazing in the Columbia River Estuary as needed: Same effects as described above for the Proposed Action of the Draft EA, except that perhaps less terns would occupy the three upstream islands resulting in less required dissuasion and hazing. Since streaked horned larks and Caspian terns use different habitats and have not been shown in the past to overlap on these islands, there is very little concern over potential impacts to nesting streaked horned larks.

Management of inland Caspian tern nesting locations: Same effects as described above for the Proposed Action of the Draft EA except that less Caspian terns would be expected

to attempt nesting at the interior sites with more available habitat provided at East Sand Island.

Management of Caspian terns in the Columbia Plateau Region: Same effects as described above for the Proposed Action of the Draft EA, with relocation of terns dissuaded from Goose Island expected to prospect at the interior locations and/or the Columbia River Estuary.

Reduction in nesting pairs of double-crested cormorants on East Sand Island: Same effect as described for the Proposed Action of the Draft EA, except that less total numbers of Columbia Basin juvenile salmonids are expected to be consumed in 2014 (by cormorants and Caspian terns combined) because Caspian terns will be expected to occur in lesser numbers upriver (where marine forage fish are less numerous) compared to the Proposed Action of the Draft EA.

Creation or enhancement of potential Caspian tern nesting habitat at Don Edwards National Wildlife Refuge, south San Francisco Bay: Same effects as described above for the Proposed Action of the Draft EA. No nesting sites at Don Edwards would be constructed prior to the 2014 nesting season.

CHAPTER 7
REQUIREMENTS WITH LAWS AND EXECUTIVE ORDERS

a. National Environmental Policy Act: This EA is in compliance with the requirements of the National Environmental Policy Act. This EA addresses potential impacts of project alternatives and incorporates comments from the public and government agencies to aid in the determination of the significance of the action to the quality of the human environment.

b. Endangered Species Act: The Proposed Action of the Draft EA was mainly concerned with reducing Caspian tern colony size to benefit ESA-listed salmonids by reducing predation on juveniles in the long term. The Proposed Action of the Draft EA was intended to address salmonid recovery in the Columbia River Basin in accord with the existing FCRPS Biological Opinion. It was determined, however, that the No Action for 2014 would be more beneficial to ESA-listed salmonids. No consultation is being pursued with National Marine Fisheries Service for the action in 2014.

c. Clean Water Act: No fill or excavation will occur in wetlands with the Proposed Action of the Draft EA or the No Action. Nearby waters will not be affected. All work will occur on uplands.

d. Clean Air Act: No emissions would result from implementation of the Proposed Action of the Draft EA or the No Action.

e. Natural Historic Preservation Act: A survey of potential cultural resources was completed on East Sand Island (Corps 2014e). A determination of No Effect will be submitted to the Oregon State Historic Preservation Office. No impacts to cultural resources are expected with implementation of the Proposed Action of the Draft EA or the No Action. Ground disturbance (disking) will occur on the East Sand Island Caspian tern nesting colony, which is located on previously placed dredged material. Dissuasion material will be placed near the west end of the island for the first time and on the east shore of the island as in years past; this area however is low-lying and subject to erosion/deposition. A pedestrian cultural resource survey occurred during January, 2014. Coordination was occurring with SHPO at the time of signature of the FONSI. The Corps will coordinate further with SHPO until concurrence is obtained.

f. Native American Graves Protection and Repatriation Act: If human remains are incidentally discovered during construction, the Corps and/or contractor will be responsible for following all NAGPRA requirements.

g. Coastal Zone Management Act: Not applicable, as the project will not affect the coastal zone.

h. Fish and Wildlife Coordination Act: This is not a water-resources project and is not subject to this act.

i. Marine Protection, Research, and Sanctuaries Act: Not applicable.

j. Executive Order 11988, Flood Plain Management: No effect as floodplains in the proposed project area would not be altered with the Proposed Action of the Draft EA or the No Action.

k. Executive Order 11990, Protection of Wetlands: No wetlands would be affected by construction of the proposed project with the Proposed Action of the Draft EA or the No Action. All work will occur on uplands and intertidal areas.

l. Analysis of Impacts on Prime and Unique Farmlands: Not applicable, as no farmlands are present in the proposed project area.

m. Comprehensive Environmental Response, Compensation, and Liability (CERCLA) and Resource Conservation and Recovery Act (RCRA): Presence of HTRW would be responded to within the requirements of the law and Corps regulations and guidelines with the Proposed Action of the Draft EA or the No Action.

CHAPTER 8
COORDINATION AND RESPONSES TO COMMENTS

This EA was prepared to address the requirements of the National Environmental Policy Act (NEPA) and was issued for 30-day public and agency review under Public Notice CENWP-PM-E-14-02. This EA was sent to government agencies and other groups. Public comments are addressed below.

Comment 1: The proposed action in the Draft EA would further reduce the available Caspian tern nesting habitat on East Sand Island from 1.58 acres to 1.08 acres. This proposed action would likely reduce the area of available Caspian tern nesting habitat on East Sand Island to an acreage that would not accommodate all of the up to 7,400 breeding pairs of Caspian terns that have nested on East Sand Island over the past three years. This action, coupled with on-going efforts to dissuade terns from nesting elsewhere on East Sand Island and in the Columbia River estuary, would likely provide the "push" necessary to further reduce the number of Caspian terns breeding in the Columbia River estuary, thereby further reducing Caspian tern impacts on survival of ESA-listed Columbia Basin salmonid smolts. Based on current re-sighting data for Caspian terns banded on East Sand Island, some if not most of the Caspian terns dissuaded from nesting on East Sand Island in 2014 would relocate and attempt to breed at the Corps–constructed tern islands located in interior Oregon and northeastern California. The proposed action would result in significant progress toward the objective of the Caspian Tern Plan to reduce the size of the East Sand Island Caspian tern colony to the range of 3,175 to 4,375 breeding pairs.

Response 1: Incorporated into this Final EA.

Comment 2: The FEIS and ROD (Caspian Tern Plan) used five acres of managed Caspian tern nesting habitat on East Sand Island as the starting point for the managed reduction in nesting habitat to reduce Caspian tern colony size (4.4 acres was used as the starting point in the Draft EA, page 3, paragraph 1).

Response 2: Incorporated into this Final EA.

Comment 3: Table 1: Sheepy Lake and Orems Unit are in Siskiyou County, CA, not Klamath Co., Oregon.

Response 3: Incorporated into this Final EA.

Comment 4: A colony size of 7,600 nesting pairs is used throughout the Draft EA as the number of Caspian tern pairs that nested in the designated colony site on East Sand Island in 2013. However, our analysis of aerial photography and data collected on colony indicates that 7,111 nesting pairs is the best point estimate for number of breeding pairs that used the designated colony area. If those pairs that attempted (unsuccessfully) to nest in the satellite colonies on the upper beach on East Sand Island are added, that would bring the point estimate up to 7,400 breeding pairs.

Response 4: Incorporated into this Final EA.

Comment 5: At the bottom of page 10, the Draft EA states erroneously that Caspian tern nest density on the Crump Lake tern island is slightly higher than the Caspian tern nest density on East Sand Island in 2013. At the bottom of page 19 this mistake is repeated. The nest density of Caspian terns on Crump Lake tern island has never been close to the nest density on East Sand Island in 2013, the highest nest density we have observed at any colony we have monitored over the last 10 years.

Response 5: Incorporated into this Final EA.

Comment 6: The target Caspian tern colony size on East Sand Island switches between 2,500 to 3,125 breeding pairs and 3,125 to 4,375 breeding pairs several times in the text of the Draft EA. Which range is currently considered the target size for the East Sand Island Caspian tern colony by the Adaptive Management Team? That target colony size should be described early in the Draft EA and consistently adhered to throughout in order to avoid confusion about objectives.

Response 6: Incorporated into this Final EA. A total of 3,125 to 4,375 nesting pairs is the target for 1.5 to 2 acres of nesting habitat, while 2,500 to 3,125 nesting pairs is the final goal for the number of nesting Caspian tern pairs on East Sand Island.

Comment 7: Near the bottom of page 12, the method is described for dissuading Caspian terns from nesting on half an acre of the current 1.58 acres of designated Caspian tern nesting habitat on East Sand Island. The dissuasion materials are described as "temporary and removable" so that they could be removed if less than 3,000 nesting pairs of Caspian terns are present on East Sand Island by July 1. The removal of this amount of temporary dissuasion materials in the middle of the nesting season would cause a major disturbance to the Caspian tern colony, including loss of eggs and chicks to predatory gulls, and consequently would require a MBTA take permit. In addition, setting July 1 as the trigger date for dissuasion removal would likely be too late for Caspian terns to re-nest elsewhere. In our view, the plan to remove the dissuasion material as described in the draft EA has the potential to harm, not help, Caspian terns attempting to nest on East Sand Island. We recommend that the Caspian tern dissuasion that is erected on a half acre of nesting habit be left in place throughout the 2014 nesting season. If the reduction in nesting habitat to 1.08 acres results in unintended consequences to the Caspian tern colony, the Adaptive Management Team can make adjustments before the 2015 nesting season.

Response 7: Incorporated into this Final EA.

Comment 8: In the 2nd paragraph on p. 16 the Draft EA mentions r^2 values of 0.72 (for the correlation between eagle disturbance rates on nesting Caspian terns and May river discharge) and 0.42 (for the correlation between Caspian tern nesting success and June river discharge), and then implies that these are weak correlations because the r^2 values

aren't closer to 1.0. These are actually high r^2 values for ecological relationships, and indicate that river discharge is an excellent predictor of eagle disturbance to Caspian terns and a good predictor of Caspian tern nesting success on East Sand Island. At the end of the paragraph, it mentions that greater river discharge is generally associated with decreased water clarity, which has a "negative effect" on availability of marine forage fish. In the cited paper by Hostetter et al. (2012), low water clarity (high turbidity) was actually associated with higher Caspian tern predation rates on steelhead smolts, not lower. The inverse relationship between river discharge and availability of marine forage fish is more likely due to the low salinity of estuary waters during periods of high river discharge, not the high turbidity.

Response 8: Incorporated into this Final EA.

Comment 9: In the first paragraph on p. 17, the Draft EA mentions that the proposed reduction in acreage of Caspian tern nesting habitat on East Sand Island is necessary in order to alleviate "undesired expansion of the Caspian tern population in the Columbia River estuary in future years." There are certainly upper limits to nesting density in Caspian terns, and those may have been reached on East Sand Island in 2013. A reduction in acreage to 1.08 acres would certainly result in a significantly smaller colony size in 2014.

Response 9: Incorporated into this Final EA.

Comment 10: On the bottom of p. 20 and top of p. 21 the Draft EA predicts that the proposed action, reducing the area of nesting habitat on East Sand Island, will not reduce smolt predation in 2014, and might even result in an increase in smolt predation in 2014. While we agree that Caspian terns foraging in the Rice Island/Miller Sands Spit area of the estuary are likely to consume more juvenile salmonids than Caspian terns foraging near East Sand Island, we think it is unlikely that large numbers of Caspian terns that can't find space to nest at East Sand Island would instead remain near Rice Island/Miller Sands Spit for the entire smolt out-migration. As long as Caspian terns that attempt to nest at the dredged material disposal islands in the upper estuary (i.e., Rice Island, Miller Sands Spit, Pillar Rock Sands) are persistently hazed and dissuaded (as they have been the last few years), these displaced Caspian terns will look for alternative colony sites in which to nest, and if none are available in the Columbia River estuary, they will leave the estuary before the end of the breeding season.

Response 10: Incorporated into this Final EA.

Comment 11: On page 24, the benefits to eulachon from the proposed reduction in Caspian tern nesting habitat at East Sand Island are discussed. Eulachon have not been documented in Caspian tern diets at East Sand Island. In most years there is very little or no temporal overlap in the eulachon spawning run and the Caspian tern nesting season. Given the lack of evidence that Caspian terns prey on eulachon in the Columbia River estuary, the emphasis in the Draft EA on reducing Caspian tern impacts on eulachon as a justification for the proposed action seems unwarranted.

Response 11: Incorporated into this Final EA.

Comment 12: On page 27 it states that the proposed action may result in fewer ring-billed gulls nesting in the prepared Caspian tern nesting habitat. Ring-billed gulls have not nested in the prepared Caspian tern habitat on East Sand Island, and aren't expected to do so. A few dozen glaucous-winged X western gulls have nested in or adjacent to the designated Caspian tern nesting habitat on East Sand Island.

Response 12: Incorporated into this Final EA.

Comment 13: The proposed action would be at variance with the 2:1 mitigation ratio (area of Caspian tern nesting habitat created : area of Caspian tern habitat on East Sand Island removed), the ratio that was used in the 2005 FEIS and ROD (Caspian Tern Plan). The reasons and justification for this change are not clearly described or explained in the Draft EA.

Response 13: It is noted in this Final EA that the change in nesting area would be in response to unexpectedly high nesting densities of Caspian terns and would be aimed to address management objectives with respect to numbers of nesting terns, while acknowledging that compensation for Caspian tern nesting habitat loss by providing habitat elsewhere at a 2:1 ratio would not occur immediately.

Comment 14 Introduce coyotes or hogs to East Sand Island to decrease the size of the Caspian tern colony.

Response 14: Mammalian predation can have detrimental effects to Caspian tern colonies, and mammals are managed at some tern colonies. The aim is to maintain a viable, persistent colony of Caspian terns on East Sand Island, not to eliminate the colony. There is an interest in reducing the colony size to benefit ESA-listed salmonids while maintaining a viable tern colony. While the ESA-listed runs of salmonids are of management concern in the Columbia River system, so are Caspian terns. While Caspian terns are a wide-ranging bird over the world, they are not considered numerous, although they are locally abundant. As noted in this Final EA, Caspian terns are of conservation concern on a global scale because the worldwide population probably does not exceed 100,000 pairs, colonies are generally small and scattered over large areas, and populations have declined over much of their former range. Much of the interior habitat in the western U.S. also is no longer available. While Caspian terns are not federally listed under the Endangered Species Act, they are protected under the Migratory Bird Treaty Act.

Comment 15: What consideration has been given to what comprises the largest impact on numbers of juvenile salmon and steelhead – the dams on the Columbia River?

Response 15: The Corps' involvement in management of Caspian terns is designed to lessen impacts to juvenile salmonids; management considerations are outlined in the

Caspian Tern Management Plan and the Biological Opinion issued by NMFS for operation of the Federal Columbia River Power System (NMFS 2008). Actions taken to date to lessen impacts to salmonids have included moving the tern colony from Rice Island downriver to East Sand Island, construction of inland nesting sites, dissuasion and hazing of terns from potential nesting locations in the estuary, and reduction of nesting habitat on East Sand Island. The Corps is also very involved with other projects at particular dams that are designed to improve juvenile and adult salmonid passage and survival through the dams.

Comment 16: Reducing Caspian tern habitat on East Sand Island is a step toward the recovery of Columbia River salmon.

Response 16: The Corps aims to responsibly manage the Caspian tern colony at East Sand Island in order to improve prospects for Columbia Basin salmonid runs while maintaining a viable Caspian tern population.

Comment 17: Predation of all types on juvenile salmonids needs to be controlled.

Response 17: The Corps is also involved with research on impacts of cormorants, mainly double-crested cormorants, on juvenile salmonids. A large colony of double-crested cormorants (along with some Brandt's cormorants) also nest on East Sand Island. They occupy the western end of the island, while the Caspian tern colony is on the eastern end. Bird predation on juvenile salmonids in the Columbia River estuary is mainly by cormorants and Caspian terns. Brown pelicans have become increasingly common in the Columbia River estuary but are present in their largest numbers after the majority of juvenile outmigration, and have been shown to feed mainly on saltwater fish that are present in large schools such as anchovies and sardines. Saltwater forage fish are abundant in the lower Columbia River Estuary in the vicinity of East Sand Island. Concurrent with the Corps' work with Caspian terns, we are also researching impacts of cormorants and considering various management options to improve the well being of Columbia Basin salmonids while also considering the viability of the cormorant colony.

Comment 18: There is inconsistency in numbers of acres available in the Draft EA – 6.35 acres and 7.8 acres were both referenced.

Response 18: The acreage of 6.35 is correct, although this may be a topic of reconsideration in future meetings of the inter-agency Adaptive Management Team.

Comment 19: Since construction in 2008, Fern Ridge has never been used by Caspian terns and Corps monitoring has been discontinued. What is the Corps' rationale for holding this site on the active inventory of constructed habitat?

Response 19: In this EA, we wanted to identify all of the sites that have been constructed. Fern Ridge is no longer being monitored, but it has not been dropped as of yet from the program. Accounting for available acreage will be a topic of discussion in future interagency meetings of the Adaptive Management Team.

Comment 20: How are partial acreages accounted for on the constructed interior islands?

Response 20: There has been a prorating of acres of islands built in the Klamath Basin to reflect a lesser amount of area than what has actually been built (described in Corps 2012b). This is because not all islands are available in all years (e.g. Tule Lake Island had water two years in a row and then a dry year; acreages have been coordinated with the inter-agency Adaptive Management Team).

Comment 21: Caspian terns don't naturally occur in the Columbia River Estuary and their droppings tend to attract flies to boats.

Response 21: The first observed nesting of Caspian terns in the Columbia River Estuary occurred in 1984 on East Sand Island on dredged material that had been placed by the Corps. While nesting had not been reported previous to 1984 in the Columbia River Estuary, it is possible that terns have nested in the estuary long ago, especially with periodic appearance and disappearance of appropriate habitat such as sand bars. Caspian terns have great migratory and dispersal capabilities and roam widely in search of appropriate nesting habitat. Their natural nesting habitat tends to be rather ephemeral, with bare or sparsely vegetated sand becoming available and eventually disappearing or becoming too dense with vegetation. Many other fish-eating birds also occur in the Columbia River Estuary in large numbers such as cormorants, gulls, and pelicans. Bird droppings on boats have not been previously been brought forward as an issue, and are likely caused by a variety of bird species using the estuary. Gulls are likely responsible for most of the droppings while boats are docked.

Comment 22: We do not support the No Action alternative because it is predicted to result in greater numbers of Caspian terns in the Columbia River Estuary compared to implementation of the Proposed Action.

Response 22: The No Action alternative would likely result in more Caspian terns remaining in the Columbia River Estuary during 2014. Since release of the Draft EA, there has been growing concern about the viability of nesting at the interior locations in 2014 resulting from drought conditions in 2013/2014. With drought conditions, some of the interior sites will be "land bridged", caused by low water, making tern nests susceptible to mammalian predation, since mammals would be more easily able to access the nesting areas overland, or through shallow water. There is a concern under these circumstances, that terns that attempt to nest at the interior sites may relocate back to the Columbia River Estuary or to the Columbia Plateau Region, such as Blalock Island, and perhaps have large impact to juvenile salmonids since upper parts of the estuary and the Columbia Plateau don't provide the saltwater forage fish that the lower estuary does. In 2013, of the adult Caspian terns greater than five years old banded on East Sand Island, 11 were sighted on Crescent Island, 14 on Goose Island, and two on Blalock Island. The Proposed Action is predicted to result in more Caspian terns leaving the estuary for the interior but, because of the likelihood of drought conditions, there is a concern of failed nesters in the interior relocating and preying largely on juvenile salmonids.

Comment 23: From data collected in 2013, the number of nesting terns did not decrease with reduction in nesting acreage on East Sand Island, they simply nested closer together. They may nest even closer together in 2014, with the result being more, not fewer, nesting pairs.

Response 23: The trend has been toward increased nesting density of Caspian terns on East Sand Island, the highest so far being 1.1 pairs per square meter in 2013. We don't know whether 2013 nesting density will represent a peak, or how high densities might become. That even higher nesting densities of Caspian terns are possible is evidenced by observations on the Commencement Bay tern barge in south Puget Sound, which has shown nesting densities of approximately 1.5 tern pairs per square meter. The barge is of course an unnatural situation where there is no threat of mammalian predation on nests because of the vertical sides of the barge. East Sand Island is similar in that it has been largely safe with respect to mammalian predation, but perhaps could be perceived by potential nesters as less safe than a barge.

Comment 24: If nesting in 2014 occurs at the same density in 2013 but now within 1.08 acres, approximately 5,200 nests would result. This is approximately 66% more pairs than the high end of the range identified in the FEIS/ROD (Caspian Tern Plan) of 3,125 pairs. We do not see how the goal to maintain 3,125 nesting pairs is probable, unless of course eagle and gull predation occurs as was seen in 2011 and 2012. We do see the possibility of at least 5,200 nests again. Is there an action plan to reduce the number of nests if it is seen that the goal will not be met?

Response 24: The number of nesting pairs on East Sand Island in 2013 was 7,111, which is lower than identified in the Draft EA. The nesting density of 1.1 pairs per square meter in 2013 equates to 4,861 pairs over an area of 1.08 acres, which is still considerably higher than that predicted in the FEIS (Caspian Tern Plan). The Proposed Action is considered adaptive management with the aim of progressing toward goals outlined in the Caspian Tern Plan, realizing that all goals will not be met immediately. The Corps and the resource agencies are interested in reducing numbers of nesters on East Sand Island and also providing for nesting habitat elsewhere as nesting acreage is decreased on East Sand Island, as outlined in the Caspian Tern Plan. Also, the Corps and resource agencies aim to continue to pursue a viable coastal location with the goal of taking some of the nesting pressure off of East Sand Island. Caspian terns nested at a density of 1.1 pairs per square meter on East Sand Island in 2013, the highest density seen there. And the trend has been toward increasing densities. Brooks Island and Eden Landing in San Francisco Bay have supported densities of Caspian terns similar to East Sand Island, at about one pair per square meter. That terns could nest at higher densities than 1.1 per square meter is evidenced by densities of 1.5 per square meter observed at the Commencement Bay tern barge in south Puget Sound, although this was an artificial situation where the lack of land connection and vertical sides of the barge eliminate the threat of mammalian predation on nests. East Sand Island is similar in that mammalian predation has not been much of an issue, but perhaps potential nesters would perceive a barge as being safer yet.

Nesting density remains a topic of great interest and will be an important consideration for future management.

Comment 25: Terns displaced from East Sand Island may move upstream to Rice Island, Miller Sands Spit, and Pillar Rock Island where they would consume more juvenile salmonids than terns nesting at East Sand Island. We would hope that hazing with "greater intensity" at these upriver sites would be successful.

Response 25: Terns displaced from East Sand Island upriver to Rice Island, Miller Sands Spit, and Pillar Rock Island would be expected to take two to three times more juvenile salmonids per tern than those nesting on East Sand Island because availability of saltwater forage fish is less upriver, as described in the introduction. It is not certain that reducing acreage would result in more terns at these islands because of possible increased density of nesters at East Sand Island, movement of terns to the interior nesting locations in Oregon and California, and movement elsewhere such as the Columbia Plateau Region. The aim of the interior locations is to "pull" terns away from East Sand Island. Observations on numbers of birds at the three islands in question does not appear to have been correlated to nesting acreage reduction in the past at East Sand Island (Corps 2014b). Dissuasion and hazing of terns are accomplished as needed under the Columbia River Operations and Maintenance program, and is a requirement of the FCRPS Biological Opinion (NMFS 2008). The objective will remain to dissuade and haze Caspian terns as necessary on these three islands.

Comment 26: The search for an alternative coastal nesting site ignores the original problem that there are too many terns living in a man-made environment that consume very expensive salmonids. Unlike some other groups, we do not appreciate feeding what is now seen as the largest colony of Caspian terns in the world with endangered and threatened salmonids.

Response 26: The FEIS and RODs (Caspian Tern Plan) outline goals for management of Caspian terns. The Corps and resource agencies continue to adaptively manage terns. There is an interest in reducing the colony size to benefit ESA-listed salmonids while maintaining a viable tern colony. While the ESA-listed runs of salmonids are of management concern in the Columbia River system, so are Caspian terns. While Caspian terns are a wide-ranging bird over the world, they are not considered numerous, although they are locally abundant. As noted in this Final EA, Caspian terns are of conservation concern on a global scale because the worldwide population probably does not exceed 100,000 pairs, colonies are generally small and scattered over large areas, and populations have declined over much of their former range. Much of the interior habitat in the western U.S. also is no longer available. While Caspian terns are not federally listed under the Endangered Species Act, they are protected under the Migratory Bird Treaty Act. The Caspian Tern Management Plan aims to strike a balance between tern and salmonid management. Because of unexpected responses of terns to habitat manipulation, coupled with delays in procuring a coastal site, management objectives have not yet been met. The efforts of the Corps and resource agencies remain focused on meeting the objectives of the Plan.

Comment 27: The management of Caspian terns does not have as its goal a reduction in the number of nesting terns in the Columbia Basin sufficient to have a positive effect on the recovery of ESA-listed salmonids.

Response 27: The purpose of reduction of Caspian terns nesting on East Sand Island in conjunction with habitat creation elsewhere is to benefit ESA-listed salmonids in the Columbia Basin. Terns nesting at habitat created at the interior sites do not feed on juvenile salmonids. The location of a future coastal site would be chosen in part based on the availability of marine forage fish to further decrease predation on salmonids. As presented in the Caspian Tern Plan, modeling conducted by NMFS estimated the potential increase in population growth rates of the four steelhead Evolutionarily Significant Units (ESUs) based on various tern colony sizes and projected a potential increase of 0.79 to 2.5% over a period of about one generation of steelhead (4 to 5 years) with a 50% reduction of nesting terns on East Sand Island to 5,000 pairs. Consumption of juvenile salmonids has decreased since 2008 (Figure 12) with reduction of nesting pairs (Figure 10). The availability of saltwater forage fish are not seen as limited in the lower Columbia River Estuary. Continued decreases in nesting numbers of Caspian terns is expected to result in further decreases in loss of juvenile salmonids and benefits to ESU stocks in general.

Comment 28: The Draft EA moves in the right direction by reducing the amount of available nesting habitat for Caspian terns on East Sand Island, but this may not be enough to achieve the objective of reducing salmonid predation. Recent reductions in nesting habitat from 2.0 to 1.58 acres did not result in a substantive reduction in the number of nesting pairs. Further management actions are warranted in order to decrease losses of migrating salmonids.

Response 28: The number of nesting pairs on the East Sand Island colony identified in the Draft EA of approximately 7,600 was incorrect; the actual estimate was 7,111 nesting pairs. The reduction of nesting habitat on East Sand Island from 2.0 to 1.58 acres occurred before the 2012 nesting season. Despite this, number of nesting pairs did not decrease substantially from 2011 to 2012 (Figure 10) because of increased nesting density (Figure 15). The nesting acreage was held at 1.58 from 2012 to 2013, and nesting density increased even more. It is not yet known how high nesting density might get on East Sand Island, or if 1.1 pairs per square meter observed in 2013 will represent a peak. As noted in this Final EA, higher nesting density of Caspian terns (1.5 per square meter) was observed on a barge at Commencement Bay in south Puget Sound. The Corps and resource agencies are seeking additional management actions as we proceed toward meeting the goals of the Caspian Tern Management Plan, including reducing numbers of nesters on East Sand Island and pursuing a viable coastal nesting site.

Comment 29: We recommend that the Portland District actively coordinate its monitoring and adaptive management program with the Walla Walla District, which is also initiating reduction of Caspian tern nesting habitat as part of its Inland Avian Predation Management Plan in 2014. As a result of these combined activities, the

likelihood of Caspian terns seeking new nesting areas will increase significantly. It is crucial that both Districts coordinate their monitoring efforts over the 2014 nesting season.

Response 29: Walla Walla District aims to completely dissuade/haze Goose Island during the 2014 nesting season, including egg collection as necessary (Corps 2013a). This will result in likely about 400 pairs that would look for alternative nesting sites. Where they may attempt to nest is speculative. With the Proposed Action on East Sand Island, it is expected that there would be excess terns looking for alternative nesting sites; these terns would most likely go to the interior sites, as that has been the general pattern. Drought conditions in 2013/2014 is a concern because this could result in "land bridging" of the interior sites and resultant increased potential for mammalian predation on nests because of accessibility to the tern colonies. Also, low water in the interior could prevent attempts at nesting.

Comment 30: The Oregon estuaries are home to federally threatened runs of coho salmon and establishment of a new Caspian tern colony in this area is not supported.

Response 30: Caspian terns are known to have nested along the Oregon coast only in the Columbia River Estuary. An evaluation of potential coastal sites was completed by USFWS (2003). The only coastal sites identified in Oregon that contained potential tern habitat were in Coos Bay and the Umpqua River Estuary. Because of large issues with ESA-listed salmonids at both of these locations, they are not currently being considered as potential sites for establishment of tern nesting colonies.

Comment 31: The proposed action includes temporary placement of barriers on East Sand Island to reduce nesting habitat. We are concerned that the proposed removal date of July 1 for those barriers may not be late enough in the breeding season to prevent late nesting attempts. It is reported in the Draft EA that Caspian terns remained on the island into August in 2012. This indicates that eggs laid in July could be successfully hatched. Consideration should be given to delaying the barrier removal date at least two weeks later in July.

Response 31: Temporary barriers won't be placed, mainly because it was decided that removal of those barriers at any time during the nesting season could cause disturbance of the tern colony and resultant nest predation by gulls.

Comment 32: It is likely that the reduction in Caspian tern nesting area to 1.08 acres will be an intermediate step toward achieving the goals of the Caspian Tern Management Plan, assuming that nesting densities won't be higher than observed in 2013, which may not be the case.

Response 32: It is anticipated that reduction of tern nesting acreage on East Sand Island would have benefits in reducing the numbers of nesters compared to 2013. The estimated number of nesting pairs on the 1.58 acre East Sand Island colony in 2013 was 7,111 pairs, a density of 1.1 pairs per square meter. The trend at East Sand Island has been

toward greater nesting density and it is unknown if the density observed in 2013 will represent a peak, or how high density could get. That higher density is possible is evidenced by a density of 1.5 pairs per square meter observed at Commencement Bay barge in south Puget Sound.

Comment 33: Historically, prior to the mid-20th century before construction of islands from dredged material, there was very little appropriate habitat in the lower Columbia River Estuary for Caspian terns to nest.

Response 33: This is supported by the lack of evidence historically of Caspian terns nesting in the Columbia River Estuary (e.g. Gabrielson and Jewett 1940; Burroughs 1961). The first confirmed nesting of Caspian terns in the estuary was at East Sand Island in 1984 on recently placed dredged material.

Comment 34: A public comment period that encompasses at least one of our Council meetings to allow the Council and its advisory groups the opportunity to formally comment would be beneficial.

Response 34: The EA went out for public review based on a detailed schedule of events that was necessary to take action regarding tern management for this year. We will try to coordinate with you in the future prior to release of NEPA documents being released for Caspian tern management on East Sand Island, although sometimes proposed actions are refined during the development of an EA as information is compiled.

Comment 35: Oiling of eggs has been effective to kill cormorant eggs in a study in Michigan.

Response 35: Oiling of eggs has been used effectively as a method to reduce recruitment to cormorant populations while preventing renesting. Caspian tern colonies are more susceptible to disturbance than are cormorant colonies and abandon nests more easily. Oiling of eggs is not a viable method for Caspian tern management on East Sand Island. An aim of the Caspian Tern Plan is of course to reduce predation by terns on juvenile salmonids but also to maintain a viable tern colony. Suryan et al. (2004) modeled the Pacific Coast population of Caspian terns and estimated that 0.32 to 0.74 fledglings per pair would be required to maintain a stable population. From Figure 6, production at East Sand Island has been well below 0.32 since 2010, with a high of approximately 0.2 in 2013. Although Caspian tern numbers at East Sand Island are higher than predicted in the Caspian Tern Plan, recruitment to the population is also a concern from the standpoint of long-term stability. Future recruitment is a concern because of recent problems will eagle and gull predation causing much nest failure on the East Sand Island colony.

Comment 36: Predator control could be done for less cost by opening hunting seasons on the predators to the public.

Response 36: Predator control is an important component to Caspian tern management. Caspian tern management on East Sand Island does not aim to eliminate recruitment of

terns to the population, but rather to maintain a stable population albeit at lower numbers of nesters than currently exist. Caspian tern colonies are very susceptible to human disturbance, and predator control must be done in a controlled manner.

Comment 37: The Corps fails to identify replacement sites for the terns it proposes to relocate from East Sand Island. Instead it only offers a vague commitment, without timetable, to seek coastal sites for future habitat replacement.

Response 37: The Corps and the resource agencies continue to pursue a coastal nesting site per the Caspian Tern Management Plan, but initiated this EA to investigate the proximate problem of many more nesting terns at East Sand Island than expected.

Comment 38: Thus far only 1,169 pairs of Caspian terns have been successfully relocated from East Sand Island to inland nesting areas. With the 2013 estimate of 7,600 pairs on East Sand Island, these numbers suggest that there may be less than 9,000 pairs in the western regional population; down from 11,660 pairs on East Sand Island in 2011.

Response 38: The Western Regional Population of Caspian terns reached 11,660 pairs in 2011, not the East Sand Island colony itself. The 2013 estimate of nesting pairs on East Sand Island was 7,111, not 7,600 as identified in the Draft EA. This is far above the goal of 3,125 to 4,375 nesting pairs over 1.5 to 2 acres (and the final goal of 2,500 to 3,125 nesting pairs for the East Sand Island colony) as identified in the Caspian Tern Management Plan.

Comment 39: Out of nine new tern nesting sites created to meet the requirement of the 2005 Tern Plan, four were unoccupied in 2013 and five produced no fledglings in 2013. In addition two were dry or partially dry creating situations unsuitable for nesting and one has been removed from the program altogether due to "unsuitable conditions for nesting."

Response 39: Correct.

Comment 40: The East Sand Island colony has experienced near zero productivity (lack of recruitment) during the last three years (2011 to 2013). Although the Caspian tern is a long-lived species, we would expect some attrition that will affect the size of this cohort which makes up perhaps 60% of the Western Metapopulation.

Response 40: Recruitment to the Caspian tern population from the East Sand Island colony has been low from 2010 to 2013 and for each of these four years has been below the Suryan et al. (2004) estimate of 0.32 to 0.74 fledglings per nesting pair to maintain a stable population.

Comment 41: The EA notes that the proposed actions may not reduce salmonid predation during 2014 and could in fact increase salmonid predation due to increased foraging by displaced terns foraging further up in the estuary. Instead the efficacy of the EA is predicated on the concept that the proposed action will lead to long term reductions in predation due to reduced nesting success. While this hypothesis may have made sense

in 2005, it would appear to be completely out of alignment with data collected over the past several seasons which shows that despite high concentrations of nesting terns on East Sand Island, productivity has been at or close to zero. We question why given very low productivity, the Corps would embark on an effort that could potentially drive displaced terns to even more problematic locations to forage. Unless the Corps has reason to believe that displaced terns will eventually leave the estuary area entirely, an outcome that seems highly uncertain given the general lack of success at alternative nesting sites and the failure to identify new nesting sites, the proposed action would appear to have a high probability of resulting in either no net benefit or an adverse outcome.

Response 41: Most Caspian terns leaving the Columbia River Estuary have gone to the interior sites. The interior sites have experienced drought conditions in 2013/2014, and may not be viable nesting locations in 2014 caused by "landbridging" and accessibility of predatory mammals to the nesting grounds. It is possible that terns leaving the estuary and attempting to nest at the interior sites would, after failed nesting, return to the estuary or go to the Columbia Plateau Region, or other locations to nest. Also, regarding productivity, see the response to the prior question.

Comment 42: A plan has been adopted by the Corps to relocate two Columbia Plateau colonies at Goose Island and Crescent Island and to dissuade any new nesting in the Basin. We do not believe that this effort is likely to be any more successful than the current efforts with the East Sand Island colony. Therefore there will be a small, but we believe, significant reduction in numbers of nesting terns.

Response 42: Please refer to the Final EA for Inland Avian Predation Management. This EA for East Sand Island is concerned with reducing unexpectedly large numbers of nesting Caspian terns on East Sand Island. Colony size is far above the goal of 2,500 to 3,125 nesting pairs for the East Sand Island colony as identified in the Caspian Tern Management Plan. As with the work on East Sand Island, management on the Columbia Plateau also relies on research results.

Comment 43: We are concerned about the ongoing lethal control of Caspian terns to collect data for diet studies. This lethal control has now been occurring for more than a decade and has long past any valid claim on providing useful scientific data for the purposed of tern management.

Response 43: Collection of diet data this way has not been a concern with respect to the well being of the East Sand Island Caspian tern colony and has provided valuable data on the fish composition of Caspian tern diets.

Comment 44: The EA fails to assess whether concentrating the terns into increasingly small areas on East Sand Island could be increasing the risk of predation by eagles and gulls. It is possible that the Corps by concentrating Caspian terns into a very small area on East Sand Island and eliminating all other proximal nesting opportunities has exacerbated the potential for chronic colony failure due to eagle harassment and gull predation.

Response 44: It is possible that concentrating the colony could increase the risk of complete reproductive failure of the colony from eagle/gull harassment, although complete failure did occur in 2011 with a colony area of two acres.

Comment 45: The EA fails to assess the relationship of hatchery fish management activities to tern nesting populations. It does note that tern populations on East Sand Island peaks at the same time as many upriver hatcheries release their fish. The Corps should assess whether different hatchery management protocols might reduce tern nesting on East Sand Island.

Response 45: There is currently no goal to assess hatchery management with tern predation on juvenile salmonids.

Comment 46: The EA fails to assess the potential impacts of tern management activity on brown pelicans that roost on East Sand Island. In the past, the Corps has dismissed this concern. However, reports from local observers suggest that in fact hazing activity may be causing disturbance to the brown pelican population. Further analysis is required.

Response 46: Further analysis of potential impacts to California brown pelicans has been incorporated into this Final EA. Dissuasion on East Sand Island in 2014 will involve initially approximately five acres, with an additional approximately 1½ acres if needed as described in this Final EA. The initial five acres will occur from March 21 – April 15 before great majority of pelicans arrive in the estuary. Because of this increased dissuasion, hazing on East Sand Island will likely be more limited than in the past, and may not occur at all during 2014.

Comment 47: The EA fails to assess the impacts of hazing activity on East Sand Island, Miller Sands Spit, Pillar Rock and Rice Island on nesting streaked horned larks. Hazing is being conducted on Rice Island to prevent tern re-colonization and on Miller Sands Spit and Pilar Rock to prevent the possibility of tern nesting. Streaked horned larks were listed as threatened under the Federal Endangered Species Act in October, 2013. The dredge spoil islands provide a critical part of the remaining suitable habitat for the larks. Hazing, intended to discourage terns from nesting on the dredge spoil islands could also disrupt the nesting of streaked horned larks, a species perhaps as imperiled as the salmonids that the Corps is attempting to protect. The failure to assess the potential impacts of hazing and other tern related management activities on streaked horned larks represents a significant and surprising omission from this EA, especially given the recent listing decision and the fact that this issue has been repeatedly flagged in prior comments from environmental stakeholders.

Response 47: This analysis is included in this Final EA.

Comment 48: The EA should do a better job of placing salmonid predation in context of overall Columbia River populations. A description should be provided that explains what

percentage of the population this predation represents and what it means for long-term trends of salmonid populations.

Response 48: This Final EA expanded on the Draft EA to include more information regarding Caspian tern predation on Salmonids.

Comment 49: The Proposed Action would have negative impacts to California brown pelicans due to increased hazing activities.

Response 49: More dissuasion of Caspian terns will be done on East Sand Island this year compared to 2013 which will likely result in less required hazing.

Comment 50: East Sand Island is a critical communal roost site for the brown pelican in the Pacific Flyway, and in 2013 was the site of the first known breeding attempt ever in Oregon and Washington. As a biologist with a special emphasis on the brown pelican, including many years of observation at East Sand Island, I found the EA to be very inadequate in terms of reflecting potential effects and cumulative impacts of the proposed action on this species. Many years of pelican monitoring data and focused research results related to disturbance on the island are available, yet these details are omitted from the EA. The USACE is both the steward and primary source of harm to pelicans on East Sand Island, due to disturbance from research and management activities. I believe that the Corps needs to develop a scientifically credible conservation plan for the brown pelicans to ensure that adequate undisturbed communal roosting habitat is provided on the island.

Response 50: Potential impacts to California brown pelicans are discussed in this Final EA. Currently there are no plans to develop a conservation plan for pelicans on East Sand Island.

Comment 51: Large shifting sand islands, including East Sand Island, naturally occurred in the Columbia estuary prior to artificial stabilization. Sand islands and the species that inhabit them should be managed as a valuable part of the natural estuarine ecosystem to the extent possible. Restoration of natural island habitat, including allowance of native predators and some erosional processes, should be considered over current management practices, and may achieve agency goals in a more passive and humane manner. Current management at East Sand Island seems to favor species imbalance, perpetuation of management problems, mounting costs, negative impacts on non-target species, deterioration of aesthetic qualities, and potential loss of cultural resources.

Response 51: Although appropriate habitat for nesting of Caspian terns likely presented itself at times historically in the Columbia River Estuary, there is no evidence of Caspian tern nesting in the estuary before 1984. The availability of dredged material disposal sites resulted in nesting of Caspian terns in the estuary, although these sites were present for decades without being used by terns. Without treatment, dredged material disposal sites become vegetated and are not viable for Caspian tern nesting after about three years. It is acknowledged that there is currently an imbalance on East Sand Island with respect to

numbers of nesting Caspian terns. Additional information is presented in this Final EA regarding cultural resources, and implementation of the Proposed Action would be in compliance with the State Historic Preservation Act.

Comment 52: The proposed action also represents another example of an unreasonable approach for attempting to restore salmon runs in the Columbia River Basin under NOAA mandates. There is no realistic exit strategy in this battle against birds. Seabirds will continue to be drawn to the region as long as there is abundant prey and potential nesting habitat within the system. The prey includes numerous coastal pelagic species that fluctuate with ocean and river conditions, hatchery released salmon that are readily available despite environmental conditions, and relatively few wild salmon smolts. Seabirds are a desirable part of the Columbia River ecosystem and there is no proof that they are having negative impacts on wild salmon returns. I believe it is time to consider an entirely different approach for management of these native birds and their habitat in the region. I encourage the Corps to revisit the overall plan, consider the expertise of additional outside seabird and fishery ecologists, and develop more sustainable strategies for ecosystem management in the lower Columbia.

Response 52: With respect to Caspian tern management, working within unnatural environmental situations is currently unavoidable in the Columbia River. The strategy is to implement the Caspian Tern Management Plan. Relative consumption of salmonids and non-salmonids is expected to vary by year (Figure 3) as relative abundances and environmental conditions vary.

Comment 53: The major and perhaps only impetus for Caspian terns to move off of Rice Island was provided by continued harassment at Rice Island during and after egg laying that has continued.

Response 53: Harassment was necessary to move Caspian terns off of Rice Island. Also required was habitat preparation and social attraction at East Sand Island. Harassment and egg collection at Rice Island has been necessary during some years but not to a great extent. Caspian terns are now very committed to nesting on East Sand Island, and this has resulted in much less juvenile salmonids taken in the Columbia River Estuary.

Comment 54: The efficacy of decoys and calls is unclear.

Response 54: The results indicate that social attraction techniques used have been effective in relocating Caspian terns from Rice Island to East Sand Island and from East Sand Island to most of the interior sites. Various ecological factors may be important in sparse use of some of the interior sites, and social attraction in some cases may require more time for colonies to become established.

The first known nesting of Caspian terns in the Columbia River Estuary was in 1984, despite decades of presence of sandy islands of suitable habitat for nesting created from dredged material disposal. Of course, no social attraction was done at that time and it took decades for Caspian terns to find this habitat in the estuary.

Establishment of control sites, i.e. areas of suitable habitat without social attraction, for comparison to sites that were actively managed to attract Caspian terns was non practicable during the times when terns were being moved off of Rice Island and then off of East Sand Island. Therefore, there is no way to assess the influence of social attraction of Caspian terns to East Sand Island and to the interior sites by statistical means. Social attraction has been shown to be effective in managing bird populations, however; pertinent references include the following:

Jones, H.P. and S.W. Kress. 2012. A review of the World's Active Seabird Restoration Projects. Journal of Wildlife Management 76:2-9.

Kress, S.W. 1983. The Use of Decoys, Sound Recordings, and Gull Control for Re-establishing a Tern Colony in Maine. Colonial Waterbirds 6:185-96.

Parker, M.W., S.W. Kress, R.T. Golightly, H.R. Carter, E.B. Parsons, S.E. Schubel, J.A. Boyce, G.J. McChesney, and S.M. Wisely. 2007. Assessment of Social Attraction Techniques Used to Restore a Common Murre Colony in Central California. Waterbirds 30:17-28.

Roby, D.D., K. Collis, D.E. Lyons, D.P. Craig, J.Y. Adkins, A.M. Myers, and R.M. Suryan. 2002. Effects of Colony Relocation on Diet and Productivity of Caspian Terns. Journal of Wildlife Management 66:662-673.

Comment 55: The focus on adaptive management suggests that efforts have devolved to the state that managers really don't know what to do.

Response 55: The research on Caspian terns in the Columbia River Estuary has contributed largely to the knowledge of Caspian tern ecology, and will continue to influence management decisions as we learn more and proceed toward meeting the goals of the Caspian Tern Management Plan. Adaptive management is critical to meeting goals.

Comment 56: Low reproductive output of the East Sand Island colony over the past four years should begin having effects to the population by year 2014 or 2015.

Response 56: Suryan et al. (2004) modeled the Pacific Coast population of Caspian terns and estimated that 0.32 to 0.74 fledglings per pair would be required to maintain a stable population. From Figure 6, production at East Sand Island has been well below 0.32 since 2010, with a high of approximately 0.2 in 2013. Although Caspian tern numbers at East Sand Island are higher than predicted in the Caspian Tern Plan, recruitment to the population is also a concern from the standpoint of long-term stability of the Caspian tern colony on East Sand Island. Future recruitment is a concern because of recent problems will eagle and gull predation causing much nest failure on the East Sand Island colony.

Comment 57: Much of the statistical underpinnings of the bioenergetics model are questioned, particularly the validity of confidence intervals generated about means. It is

proposed that an independent review be launched. Reference is made to the following publications:

Furness, R.W. 1978. Energy Requirements of Seabird Communities: A Bioenergetics Model. Journal of Animal Ecology 47:39-53.

Roby, D.D., D.E. Lyons, D.P. Craig, K. Collis, G.H. Visser. 2003. Quantifying the Effect of Predators on Endangered Species Using a Bioenergetics Approach: Caspian Terns and Juvenile Salmonids in the Columbia River Estuary. Canadian Journal of Zoology 81:250-265.

Response 57: The above referenced papers went through rigorous peer review required for publication. The proper forum for questioning the validity and application of the bioenergetics model is through publication of work that can be equally peer-reviewed.

Comment 58: The EA does not consider actions or policies that could be taken to improve salmonid survival rates such as aspects of hatchery transport, improved hatchery fish release sites, and hatchery feeding systems.

Response 58: This EA is concerned with meeting the objectives of the Caspian Tern Management Plan in order to reduce predation on ESA-listed juvenile salmonids. The Corps is involved with other projects aimed at improving survival of juvenile salmonids such as passage through the dams, hatchery programs, and habitat restoration work.

Comment 59: Hazing may affect ESA-threatened marbled murrelets on Rice Island and Miller Sands Spit, which are designated critical habitat.

Response 59: These islands may appear to be mapped as designated critical habitat on some publications, but they are not. Marbled murrelets require old growth forests for nesting which is not present on these islands. Marbled murrelets are not expected to use these islands for any activity.

Comment 60: Rigorous monitoring and evaluation of tern displacement is essential because the nearly one-third reduction in nesting area is also the first change in the available nesting area in two years. The Portland District is urged to coordinate its monitoring and adaptive management program with the Walla Walla District, which will be implementing the Inland Avian Predation Management Plan in 2014. In carrying out monitoring and hazing activities throughout the Basin, the Corps should be cognizant of the higher likelihood of displaced terns from two dissuasion actions and plan accordingly.

Response 60: Monitoring and dissuasion and hazing will occur as necessary at Rice Island, Miller Sands Spit, and Pillar Rock Island; it is recognized that this may entail more effort than in 2013. The Portland District has incorporated much information from the Walla Walla District's Inland Avian Predation Management Plan into this Final EA, and both agencies presented the status of their respective programs at Portland District's monthly Fish Forum on February 25, 2014 (Corps 2014c). The two districts look forward

to working closely together as we proceed toward meeting our respective management goals.

Comment 61: A holistic, coordinated approach on a regional scale that includes both the Columbia River Estuary and Columbia River Plateau, as well as addressing other seabirds such as cormorants and pelicans, under a single regional management plan is necessary to address the overall impact of Caspian tern predation on the survival of Upper Columbia River (UCR) steelhead and UCR spring Chinook, both of which are listed under ESA. Lack of a regional coordinated approach appears to be short-sighted. The effects of Caspian tern predation on UCR steelhead and spring Chinook are well documented in the Columbia River Plateau.

Response 61: The upcoming implementation of Walla Walla District's Inland Avian Predation Management Plan has been discussed in this Final EA, and both agencies presented the status of their respective programs at Portland District's monthly Fish Forum on February 25, 2014 (Corps 2014c). The two districts look forward to working closely together as we proceed toward meeting our respective management goals. While Portland and Walla Walla Districts will coordinate closely on their future actions, there is currently no plan to have both programs covered under a single management plan. Requirements for Portland District work were borne out of a lawsuit that resulted in an EIS and RODs (the Caspian Tern Plan) and a Biological Opinion that set forth goals and requirements specific to management of Caspian terns in the Columbia River Estuary.

The Portland District is currently preparing an EIS for management of cormorants on East Sand Island that will consider cumulative impacts of actions taken in 2014 regarding Caspian tern management on East Sand Island.

Comment 62: There is concern that the Corps is now proposing a nearly one-third reduction in the prime East Sand Island nesting habitat for Caspian terns, but is apparently abandoning its commitment to match reduction in nesting habitat with creation of alternative nesting habitat at other locations at a 2:1 ratio.

Response 62: We have not abandoned the provision of a 2:1 ratio (twice the amount of habitat created for every amount reduced on East Sand Island). With the Proposed Action, there would not be immediate compensation for loss of nesting habitat acreage on East Sand Island. However, there is a proximate problem in that the number of birds nesting on the given acreage on the East Sand Island colony is much more than anticipated, because terns are nesting in such high densities. As a result, the goals of the Caspian Tern Management Plan are not being met with respect to numbers of nesting pairs, and there is more predation on juvenile salmonids in the Columbia River Estuary that anticipated for the current nesting acreage provided on East Sand Island. The coastal site continues to be pursued, and it is planned that when this site is established, much of the nesting pressure will be taken off of East Sand Island. Nesting density, numbers of pairs, acreage, and a suitable coastal site are all important considerations to the multi-agency Caspian Tern Adaptive Management Team as we proceed toward meeting the goals of the Caspian Tern Management Plan.

Comment 63: The Corps' Proposed Action detailed in the Draft EA includes a vague commitment to continue to seek creation of coastal nesting habitat for Caspian terns.

Response 63: The Corps, in collaboration with the resource agencies, continue to pursue establishment of a coastal nesting site for Caspian terns. Although there have been difficulties in identifying a suitable site, we have confidence that this goal of the Caspian Tern Management Plan will be met and we are currently engaged with the resource agencies in identifying a suitable site.

Comment 64: The Draft EA is heavily biased toward salmonids and does not provide the public with adequate information to fully evaluate measures taken to ensure conservation of Caspian terns.

Response 64: As noted in response to Comment 62, the Corps and the resource agencies have not abandoned the provision of a 2:1 habitat compensation ratio and remain committed to procuring a coastal site. We are concerned currently with the large number of nesting Caspian terns on East Sand Island, and resultant high predation on ESA-listed juvenile salmonids; predation rates are much higher than desired. While the Caspian tern is not an ESA-listed species, we do recognize concern over long-term population declines globally and historical loss of interior nesting habitat in the western U.S. and the benefits of having a well dispersed population. The East Sand Island colony is the largest in the world, and abnormally large for this species. We are interested in reducing the numbers of nesters on East Sand Island, but also want a high probability that that this reduction would result in less predation on juvenile salmonids in the Columbia River Basin.

Comment 65: Why management agencies would attempt to relocate piscivorous birds to regions of historical and on-going drought and water war conflicts is confounding. The environmental condition of those sites would have been known at the time of selection. Do you see the total predictable failure of each of those chronic drought locations? Do you see the predictable failure of sites where predation and human disturbance cannot be controlled?

Response 65: The interior locations do not experience chronic drought, but do experience drought during some years. Mammalian predation is a concern during drought years because of "landbridging" of the islands where terns nest, resulting in accessibility of mammals to the nesting grounds. Predicted drought conditions in the interior during 2014 was an important consideration to the Corps' decision for 2014.

Comment 66: It is acknowledged that management actions associated with the Caspian Tern Management Plan have not yet achieved the target breeding tern colony size on East Sand Island and subsequently, projected benefits to salmonids. The increased tern nesting density cited in the Draft EA was not an expected outcome of the Plan given successful creation of suitable nesting habitat as identified in the Plan. It is recognized that the Corps has had some challenges in successfully creating suitable nesting habitat and believe this is the primary reason Caspian terns are nesting at higher densities on East Sand Island

compared to that observed in the past. We continue to emphasize that a long-term solution to reducing salmonid predation by terns in the Columbia River Basin includes the creation of suitable nesting habitat outside the Basin, facilitating tern redistribution to areas with minimal conflicts with ESA-listed species.

Response 66: There is concern with viability of interior sites during 2014 because of drought conditions and potential for lack of attempted nesting due to low water conditions and for nesting failure due to mammalian predation and subsequent movement of terns to the Columbia Plateau Region or back to the Columbia River Estuary.

Comment 67: We are concerned that the proposed action will likely not push greater portions of the current East Sand Island Caspian tern colony out of the Columbia River Basin. Without a pull from suitable habitat outside of the Basin, it is quite likely the terns would prospect for nesting areas on the nearest available habitat. These locations include other portions of East Sand Island and upper Columbia River Estuary islands. Impacts to ESA-listed salmonids would remain the same as present or could increase if terns relocate to those areas in which there has been documentation of tern predation on those threatened/endangered salmonids that are of greatest concern.

Response 67: The Corps has these same concerns, which are detailed in this Final EA.

Comment 68: Implementation of the proposed action could affect the implementation of the Inland Avian Predation Management Plan recently released by the Walla Walla District. Caspian terns banded on East Sand Island have been documented on planned management locations (Goose and Crescent Islands) identified in the Inland Plan. The increased pressure to push terns off East Sand Island without the creation of suitable nesting habitat outside the Basin will potentially increase the number of terns using Goose and Crescent Islands, increasing the management needs at those sites. In addition, several “at risk” island containing potential tern nesting habitat in the Basin were identified in the Inland Plan. If terns relocate to these “at risk” islands, salmonid predation may not decrease in the Basin.

Response 68: The Inland Plan calls for complete dissuasion of Goose Island in 2014 (approximately 400 pairs nested there in 2013), so any excess Caspian terns from the Columbia River Estuary are not expected to nest there. The Corps is concerned with potential nesting at the other sites mentioned and the resultant potential for increased salmonid predation in the Columbia River Basin.

Comment 69: Implementation of the Proposed Action could also potentially affect future management actions for double-crested cormorants if displaced terns nested outside the prepared area on East Sand Island. In 2012, Caspian terns attempted to nest in the portion of the island that was undergoing an experimental active dissuasion of double-crested cormorants. This activity resulted in preventing the terns from nesting. Double-crested cormorant dissuasion experiments are not planned for 2014. Caspian terns have been observed to form satellite colonies amongst other species. Without the dissuasion efforts, displaced terns from the prepared area may be able to nest successfully within the

cormorant nesting area. This would not result in reducing the overall number of nesting terns on East Sand Island as well as potentially making management of double-crested cormorants more difficult in the future.

Response 69: There is potential for nesting of Caspian terns on the western end of East Sand Island near the cormorant colony. This area represents approximately two acres, which will be dissuaded using stakes, ropes, and flagging in 2014. Installation of the dissuasion materials will be completed before the nesting season of terns and cormorants.

Comment 70: The area of consideration for the Cumulative Effects section should encompass the Affected Environment of the Caspian Tern Plan. This EA should be considered a supplement of the Caspian Tern Plan.

Response 70: The Cumulative Effects section was revised in this Final EA to encompass the Affected Environment. This Final EA is considered a supplement to the Caspian Tern Plan, which consists of an EIS and RODs from both USFWS and the Corps, but not in NEPA terms, i.e. it doesn't constitute a supplemental EIS.

Comment 71: The acres and number of Caspian tern breeding pair objectives for the tern nesting area on East Sand Island stated in the Draft EA are inconsistent with the Corps' Record of Decision for Caspian Tern Management to Reduce Predation on Juvenile Salmonids in the Columbia River Estuary

Response 71: Corrected in this Final EA.

Comment 72: The streaked horned lark was listed as threatened in 2013. We are reassured by the Corps' re-initiation of formal consultation with the USFWS to assess affects to streaked horned larks in the Columbia River Estuary for the Corps' Channel Operations and Maintenance Program. We understand the Corps intends to assess effects to larks of the current and possible increased Caspian tern hazing on upper Columbia River Estuary islands through the Channel Operations and Maintenance Biological Assessment. We are encouraged by the data shared by the Corps at a February 28 meeting indicating no overlap of proposed hazing areas on Rice Island and known streaked horned lark nest locations. Please reference that potential effects to larks will be analyzed in the Biological Assessment referenced above in the final EA.

Response 72: Incorporated into this Final EA.

Comment 73: The Proposed Action represents a potential change in habitat or habitat loss for California brown pelican and thus, potential effects to the species should be addressed in the Final EA. Identify existing data on California brown pelican use of East Sand Island and other roosting areas in the mouth of the Columbia River; understand how implementation of the Proposed Action would impact pelicans; and determine whether impacts rise to the level that is significant enough to influence the overall health and survival of the California brown pelican.

Response 73: Numbers of California brown pelicans have decreased since the peak year (to date) of 2009, and it is difficult to predict future numbers. Dissuasion will occur over approximately two acres at the western end of the island for the first time in 2014, which may increase the potential for entanglement of pelicans in dissuasion material. Dissuasion materials will be installed as in the past with metal posts, ropes, and flagging. Some slack is necessary with the ropes because of the limits of tension allowed by the posts, which creates higher risk for entanglement compared to ropes that would be very tight. Also, weather can loosen the ropes further, but maintenance of areas of dissuasion will occur until dissuasion materials are removed in September. Entanglement of California brown pelicans has occurred in two known instances, as described in this Final EA. In both instances, birds were released unharmed. The presence of dissuasion material apparently does not deter pelicans from roosting. There are no current plans to manage habitat on East Sand Island for roosting pelicans.

CHAPTER 9
DECISION

As described in the Draft EA and in this Final EA, the main component of the No Action was to maintain the East Sand Island Caspian tern nesting colony at 1.58 acres for the 2014 nesting season, while the main component of the Proposed Action was an 0.5-acre reduction in colony size to 1.08 acres. Reduction was desired because the number of nesting pairs on the island, estimated at 7,111 in 2013, was more than twice that predicted by the Caspian Tern Plan for the acreage provided. As a result, more than twice the number of juvenile salmonids listed under the Endangered Species Act were consumed by nesting terns at the East Sand Island colony in 2013; approximately 4.7 million. As part of a gradual nesting acreage reduction on East Sand Island in recent years in an effort to meet objectives of the Caspian Tern Plan and the Biological Opinion for operation of the Federal Columbia River Power System (2008/2010), nesting habitat has been created in the interior of Oregon and California at a 2:1 ratio to compensate for acreage lost on East Sand Island and to establish a more dispersed population of Caspian terns.

After Consideration of all public comments and upon further analysis of ecological conditions in 2014, it was determined that implementing the Proposed Action would likely impact juvenile salmonids in the Columbia River Basin more in 2014 than the No Action Alternative. Drought conditions in the interior in 2014 are creating undesirable nesting conditions for Caspian terns resulting from “landbridging” of islands where nesting colonies are located, which allows for access and nest predation by a variety of mammals, and by poor foraging conditions created by low water. Failed nesting in the interior would likely result in these terns relocating to the mid-Columbia region and/or back to the estuary. The diets of these relocated terns would likely consist of a greater percentage of juvenile salmonids than terns in the vicinity of East Sand Island because of the increased scarcity of marine forage fish with distance upriver. For these reasons, it is desired to adopt the No Action alternative of maintaining the colony at 1.58 acres in 2014 in an effort to “keep” more terns in the lower estuary where juvenile salmonids represent less of a percentage of the diet than farther upriver. At the interior nesting locations in California, Orems Unit will not have water in 2014, Tule Lake (sump 1b) will be kept watered during the nesting season, but Sheepy Lake will likely go dry between June and August. In Oregon, water at East Link and Gold Dike (Summer Lake) are currently at normal levels but forage fish availability may be a limiting factor in this area. Crump Lake in the Warner Valley of southeast Oregon is experiencing a severe drought. Currently the Crump Lake Island is landbridged and snow levels in the nearby Warner Mountains are insufficient to fill Crump Lake to adequate water levels that for successful tern nesting this season. These low water levels will also limit forage fish abundance in the Warner Valley lakes. Malheur Lake, is expected to have adequate water levels surrounding the island 2014, but only fair forage fish availability which could limit the number of terns and/or success of the terns attempting to next there in 2014.

Reduction of the number of nesting pairs on East Sand Island and commensurate reduction in predation on Columbia Basin juvenile salmonids, however, does remain the long-term goal.

Resulting from the analysis presented in this Final EA, a Finding of No Significant Impact (FONSI) was signed which concluded the NEPA process, and No Action will be taken in 2014.

CHAPTER 10
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APPENDIX

Scientific Names of Animals and Plants Mentioned in Text

Birds

Marbled Murrelet	*Brachyramphus marmoratus*
Canada Goose	*Branta canadensis*
Great-horned Owl	*Bubo virginianus*
Streaked Horned Lark	*Eremophila alpestris strigata*
Bald Eagle	*Haliaeetus leucocephalus*
Caspian Tern	*Hydroprogne caspia*
Gull	*Larus* spp.
Ring-billed Gull	*Larus delawarensis*
Glaucous-winged/Western Gull	*Larus glaucescens* x *occidentalis*
Black-crowned Night Heron	*Nycticorax nycticorax*
California Brown Pelican	*Pelecanus occidentalis*
Double-crested Cormorant	*Phalacrocorax auritus*
Brandt's Cormorant	*Phalacrocorax penicillatus*

Fish

Pacific Sand Lance	*Ammodytes hexapterus*
Sacramento Perch	*Archoplites interuptus*
Klamath Largescale Sucker	*Catostomus snyderi*
Warner Sucker	*Catostomus warnerensis*
Bass	Centrarchidae
Pacific Herring	*Clupea pallasii*
Herring	Clupeidae
Sardine	Clupeidae
Shad	Clupeidae
Sculpin	Cottidae
Chub	Cyprinidae
Minnow	Cyprinidae
Carp	*Cyprinus carpio*
Surfperch	*Embiotoca lateralis*
Anchovy	Engraulidae
Northern Anchovy	*Engraulis mordax*
Stickleback	Gasterosteidae
Three-spine Stickleback	*Gasterosteus aculeatus*
Tui Chub	*Gila bicolor*
Surf Smelt	*Hypomesus pretiosus*
Catfish	Ictaluridae
Chum Salmon	*Oncorhynchus keta*

Coho Salmon	*Oncorhynchus kisutch*
Steelhead	*Oncorhynchus mykiss*
Rainbow Trout	*Oncorhynchus mykiss*
Sockeye Salmon	*Oncorhynchus nerka*
Chinook Salmon	*Oncorhynchus tshawytscha*
Smelt	Osmeridae
Starry Flounder	*Platichthys stellatus*
Flounder	Pleuronectidae
White Crappie	*Pomoxis annularis*
Longfin Smelt	*Spirinchus thaleichthys*
Pacific Eulachon	*Thaleichthys pacificus*

Mammals

Fox	Canidae
Coyote	*Canis latrans*
Opossum	*Didelphia virginiana*
Skunk	Mustelidae
Mink	*Neovison vison*
Raccoon	*Procyon lotor*

Plants

American Dunegrass	*Leymus mollis*
European Beachgrass	*Ammophila arenaria*