

## OSPREY (*PANDION HALIAETUS*): NOTES ON UNKNOWN AND POORLY STUDIED BEHAVIORS

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**ABSTRACT.**—This paper summarizes selected data collected during my recent field studies of nesting and foraging Osprey (*Pandion haliaetus*) in Florida and Texas, and it includes descriptions of several unknown behaviors documented in photographs. The unknown courtship display of Stick-Breaking-Off-and-Presenting Display was observed several times, performed by males inside the Honeymoon Island semi-colony in Florida. During this courting display, Osprey males broke off sticks in view of their mates and brought those sticks near the female's perching site. Osprey intraspecific kleptoparasitism of nesting materials, never reported before, was observed on several occasions. A curious behavior of Osprey swallowing seagrass was also observed that may be related to the pellet casting process. The author discusses the possibility of Osprey using a low angle strike to avoid the stiff, sharp tips of some fish dorsal fin spines when striking its prey. The male Wings-Drooping-And-Shivering display observed at Honeymoon Island Osprey population is the second known record of this display for *Pandion* sp. and first record for *Pandion haliaetus*, if *Pandion cristatus* is accepted as a separate species. Other selected behaviors reported and discussed include a few comfort movements and cases where observed Ospreys were willing to take dive chances for exchange of small or partially eaten fish with a new larger one.

### INTRODUCTION, STUDY AREA AND METHODS

The Osprey (*Pandion haliaetus*) is arguably one of the most-studied raptors in the world (Poole 1989). It can be found nesting, migrating or wintering on all continents except Antarctica. My initial literature search at Peregrine Fund Research Library database using the keyword "Osprey" produced a list of about 2,400 publications. Even though there were a large number of papers published about Ospreys, only a few authors tried to summarize all available data about this species. Perhaps the most important accounts are one monograph (Poole et al. 2002) and one book (Poole 1989) devoted to Ospreys; both works summarized all published material, and both provide a comprehensive list of references. Other published books are either about raptors in general (Bent 1937, Newton 1979, Palmer 1988, Marchant and Higgins 1993, del Hoyo et al. 1994, Olsen 1995, Clark and Wheeler 2001) or, if dedicated only to Osprey (Dennis 1991, Carpenteri 1997), cover basic data about the species biology and ecology and do not provide an extensive list of references. The newest book (Dennis 2008) provides a summary of Osprey history in the British Isles and data about

migration, banding and satellite tracking research but only briefly covers data about breeding and ecology and does not provide references. It has been pointed out (Poole 1989) that despite popularity, anyone hoping to learn about Osprey is forced to consult a multitude of different sources, most of them scholarly, narrowly focused, and out of date. Poole's book (1989) and his coauthored monograph (Poole et al. 2002) successfully synthesize knowledge about Osprey, but this bird's behavior still needs more studies and the growing list of papers published in last few years will soon require a new and updated monograph summarizing the latest research.

All my observations included in this paper were collected during opportunistic field trips to study Osprey biology, ecology and behavior. During these trips I observed and documented in photographs several unknown Osprey behaviors. I also had the opportunity to study, in more detail, some of the other poorly documented behaviors that are sometimes based on anecdotal reports and are often misinterpreted in popular articles. In this paper, I concentrate on, and report, specific descriptions of several new and a few other selected behaviors

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observed during the last 3 years. My fieldwork is far from being complete. The vast amounts of data collected so far have yet to be fully summarized, and many observations still need to be verified. My field trips were taken in two states: Texas and Florida. The observations collected in Texas (primarily on the Upper Texas Coast) were in the last 3 years, mostly during the fall-winter when many Ospreys are concentrated in fish-rich spots along the Texas coast in both saltwater and freshwater habitats. In Texas, my observations of wintering individuals were mostly concentrated on Osprey feeding behavior. In April 2008, I visited Florida to collect observations and photographs which illustrate courtship and nesting behavior of the Osprey's residential populations. Many Ospreys nest in Florida in small loose colonies occupying natural habitats and man-made platforms, sometimes located on utility posts in the center of city's busy intersections. My main goal was to study Osprey behavior mostly in their natural settings.

To document my observations, I used Canon cameras 20D (with shutter speed up to 5 frames per second) and 40D (up to 6.5 frames per second) usually with 500 mm lens coupled with 1.4X teleconverter and 100–400mm zoom. I documented some nest activities from close distance. Determination of the sex of observed Ospreys was based on comparing sizes, plumage (size of the breast band) and behavior (courtship feedings, begging for food, copulation). Sexing the American Osprey using secondary sexual characteristic was discussed by Macnamara (1977).

Many of my analyses of observations were based on a collection of my photographs taken during the last few years. Photographs taken by me illustrating many Osprey behaviors can be found at <[www.pbase.com/mbb/life\\_on\\_the\\_osprey\\_time](http://www.pbase.com/mbb/life_on_the_osprey_time)>. This folder includes subfolders with extensive photo-material illustrating all behaviors described in this paper.

## RESULTS

### DESCRIPTION OF OBSERVED NEW OSPREY BEHAVIORS

#### *Stick-Breaking-Off-And-Presenting Display*

During seven days, 20–26 April, 2008, I observed and photographed the activities of a small nesting Osprey semi-colony located on Honeymoon Island in Florida. Observations usually lasted from sunrise to sundown with a few hours break during the mid-day hours. During that time, I observed and

documented, in photographs, a very interesting Osprey male courting display that I could not find any reference to in published papers. I propose to name it *Stick-Breaking-Off-And-Presenting*. I observed this display several times during the week of observations. It was performed by males in the front of their mates who were usually perched on the branch of a neighboring tree near the nest. My first observation of this behavior was intriguing but could not lead to any conclusion. It happened as a single incident when a male flew in at full speed and broke a dead branch from a tree located not too far away from a perching female. The male, after making a small circle in the air, instead of taking the collected stick to the nest, landed a meter or so away from the female while trying to hold the stick in his feet. After a moment, he lost his grip on the stick which fell to the ground. The male did not try to pick it up. This pair was not seen together on the following day and only the male remained near or on the nest that day defending it from the intruders. The day after the nest was aborted for the rest of my observation time. During that day when the *Stick-Breaking-Off-And-Presenting* was observed, the female begged for food often, but the male never offered her fish he brought to a nearby perch. The pair that day was observed to attempt to copulate once but no cloaca contact was made. During the next few days, I observed more instances in another pair, where the male was bringing sticks to a dead tree with a female perching nearby. At one time the male managed to have 2 sticks balanced on branches and came back with a clump of seagrass in his talons (Fig. 1). I could not determine the purpose of this action, and I could not positively associate this male and female with any nest during the display time. As there were no trees around with easy to break branches, this male was bringing sticks from an unseen location. The answer to understanding of this new behavior came in the late afternoon on 26 April, when I witnessed this display in detail for half an hour. On this day, I observed pair with a more advanced, but still new, nest. Materials were brought several times a day. The female, during this afternoon, was either perching on the nest or on branches nearby. The male brought nesting material and at one time fed the female with a half eaten fish. About 1804 h the male began to perform a display which I observed for the next 33 minutes (to about 1837 h). The male started looking for sticks to break off in the immediate vicinity of his perching mate. After finding one he



Figure 1. Osprey male during his Stick-Breaking-Off-And-Presenting Display in front of a perching female managed to balance 2 sticks on tree branches and come back with a seagrass clump in his talons. Honeymoon Island State Park, Florida. 20 April 2008.

could successfully break off from the tree (Fig. 2), he either flew straight to the perching female and landed not too far away from her with a stick in his talons or, sometimes, he made a full circle flight around the female before landing. Sometimes, the male presented the stick only in flight and did not land on the tree. After circling in flight around the female perching site, he would fly away with the stick in his talons. At first the female remained perched on the nest but later during the display, she moved and joined the male on the tree where the male performed his show. He often tried to perch close to her, while holding sticks with his talons. Most of the time sticks were dropped from the male's talons, but some sticks were anchored to the branch (Fig. 3). The male kept bringing new sticks to the same tree even after the female flew away to another perch. After a few tries, the male was unable to break off a stick from nearby trees. He left the area to go to another part of the island, flying

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across a small bay, but he was back shortly, usually with the stick in his talons. I observed other Ospreys bringing sticks from various parts of the island, as most trees around the active nests usually did not have many branches that were easily broken. The displaying male would first try to find a stick that could be broken within visible distance of the female, sometimes flying around for several minutes from one tree to another. Only when, after several attempts, no other breakable branches could be found in the area would the male fly away and bring a new stick from a further location. After the last try at 1837 h, the male flew away leaving the female still perching near the nest site. During the whole display, the male brought sticks at least 7 times and usually presented them to the female. The first observed presentation included 2 large sticks in his talons, but I did not observe him collecting this material. The male passed the nest with the female perching there, and after making circling flights



Figure 2. Osprey male attempting to break off a stick from a tree during the Stick-Breaking-Off-And-Presenting Display. This behavior was also the only observed method used to gather nesting material inside this Osprey semi-colony. Honeymoon Island State Park, Florida. 26 April 2008.

lasting about 1 min 14 sec, he flew to another tree near the nest. When trying to land he dropped 1 stick on the branch and left this stick anchored to the branch. Then the male tried to land on a nearby branch, firmly holding a grip on another stick while trying to maintain balance on the perch for next 16 sec. Then he started flying again with the remaining stick in his talons. After making a small circle, he disappeared from sight and was back in about 14 min flying with a new stick. During this time while the male was gone, a single Bald Eagle (*Haliaeetus leucocephalus*) showed up in the area and was chased away by other Ospreys. I could not determine whether the displaying male was a part of the group that chased away the eagle or not. After his return, the male presented a new stick in a few seconds of flight passing the female perched on the nest, and then he flew away. The male was back in sight in about 40 sec, talons empty, and he started checking nearby trees for a new stick. It took him a few seconds to snap off a new stick, but it was a very small one. The male held this stick for about 7 sec in flight, dropped it and went back to search for the next one. After about 3 min, and a few

unsuccessful tries, the male broke off a new large stick that he brought to the tree. After about 20 sec circling flight, he presented it to the female who had already left the nest and moved to perch on the tree where the male was bringing the collected sticks. The male did not land, and after passing in the front of the female, made another 17 sec circling flight and then landed on the branch next to the female perched on a nearby branch next to the first stick the male had brought and anchored on the branch. After a couple of seconds of trying to keep his balance on the branch above the female, the male, still holding a stick, flew to a lower branch (about 1 m below the female). After 3 sec he managed to balance himself with the stick in his talons and remain in this position for the next 33 sec. The male then left the last stick he brought anchored to the tree fork and for next 3 sec hovered slightly above or at the level of the perching female. Then he landed again on a lower branch right on the top of the last stick he brought. He spent 2 sec flapping his wings and trying to reposition the stick with one foot. Finally he lost his grip and the stick fell to the ground. For a couple of seconds, after losing a stick, the male



Figure 3. Osprey male bringing another stick (note one stick already balanced on the branch near the female) during his Stick-Breaking-Off-And-Presenting Display. Honeymoon Island State Park, Florida. 26 April 2008.

looked down, then he took off and flew over nearby trees looking for another stick. Again, after a few unsuccessful tries during the next 3 min 17 sec, the male finally broke off a new stick, a small one, but this time he brought this one back to the tree after a direct 5 sec flight – the female had already left and was perching on another tree nearby where she remained for the rest of the display time. This time it took the male about 7 sec to balance himself with the stick on the branch, and after resting for about 1 min he took off and made a circling flight lasting about 15 sec then landed again on the same tree. Then he tried to balance himself with the stick for about 16 sec. He held it resting for a second or so, and then dropped it to the ground while taking off. The male tried to balance himself on a nearby branch for about 17 sec then took flight. He was back at the tree with another small stick in about 1 min 9 sec. It took him about 6 sec to balance, and 15 sec to perch while holding the stick. He took off again letting the stick slide down from the branch. He kept trying to find sticks to break off nearby for 1 min 23 sec, and then he left the area and was back with a small stick after about 2 min and 42 sec. He circled around for 9 more sec. This time he lost his grip on the stick when landing. After perching again, he spent about 1 min 46 sec on the branch before he

took flight. For the next 20 sec the male tried twice, unsuccessfully, to break off a new stick then flew away (about 1 h 25 min before sunset), and I did not see him again. During the display time, none of the collected sticks were taken to the nest. The female took flight about 2 min after the male left, but she was back in about 44 sec with a clump of sea grass in her talons. She started to swallow the seagrass shortly after landing on the perch. This incident of swallowing seagrass is described in more detail in another part of this paper. As this was the last day of my observations during this trip, I did not have a chance to collect more data. During the described Stick-Breaking-Off-And-Presenting display, the Osprey male collected sticks at least 7 times (one time double), most in plain view of the perching mate. On average, he was successful in breaking and collecting a stick every 4.7 min with maximum time of about 14 min (but this long break could possibly be related to the Bald Eagle chase) and a minimum of about 1 min between the presentation of a new stick. Although a very small stick was dropped (possibly by accident shortly after breaking it off), at least 6 times different sticks were presented to the female (on average one presentation every 5.5 min). I took 584 photographs during this event for the further analysis.



Figure 4. Pirating nesting material from another Osprey nest. Note more nest material falling down than taken away. Honeymoon Island State Park, Florida. 25 April 2008.

#### *Osprey Intraspecific Kleptoparasitism of Nesting Materials*

Intraspecific kleptoparasitism of food by Ospreys was reported by Forbes (1991), but in published papers there are no references to Ospreys collecting nesting material by pirating from other Osprey nests. Ospreys building nests on Honeymoon Island in Florida were observed on several occasions. Some individuals kept coming to other temporarily unguarded nests pirating sticks from them. The thief, being successful and not chased away, often came back and tried to collect more material. In most cases, owners of the nest perched nearby and instantly chased the thief away, but usually some damage to the nest had already been done, often because of the impact of the bird. While trying to grab material in a hurry at high speed, more sticks and other nest materials fell to the ground than grabbed and carried away (Fig. 4).

#### *Swallowing Seagrass by Osprey*

On 26 April at Honeymoon Island at 1840 h, I observed a perching Osprey (presumably a female) make a short flight to the shoreline and return with a clump of seagrass in its talons. The bird did not take

this material to the nest; instead it landed on the perch and continued holding the seagrass clump (Fig. 5a). Clumps of seagrass collected from shoreline are commonly brought to nests at the Honeymoon Island colony by nesting Ospreys, but this time it was used differently. The Osprey started to take large bits of seagrass blades and proceeded to swallow them. While eating a couple of portions, the process lasted about 1 min; the rest of the clump fell down to the ground (Fig. 5b-g). After swallowing a mouthful, the bird appeared to force swallow material down the throat. After swallowing at least two portions, the Osprey took an erect posture with an extended neck and a bill stretched wide open (Fig. 5j and m-q). This action, repeated two times, started and ended with cleaning the bill by grabbing the end of a branch and rubbing the inside of the bill against the wood (Fig. 5h-i, l and s). Short resting breaks were taken after outstretching the neck and bill (Fig. 5k and r). Then the Osprey resumed a resting position (Fig. 5t) and started to preen (Fig. 5u). The bill was cleaned one more time by rubbing against the branch (Fig. 5v). After that the bird turned around, walked away a few steps and continued to perch in the resting position (Fig. 5w-y).

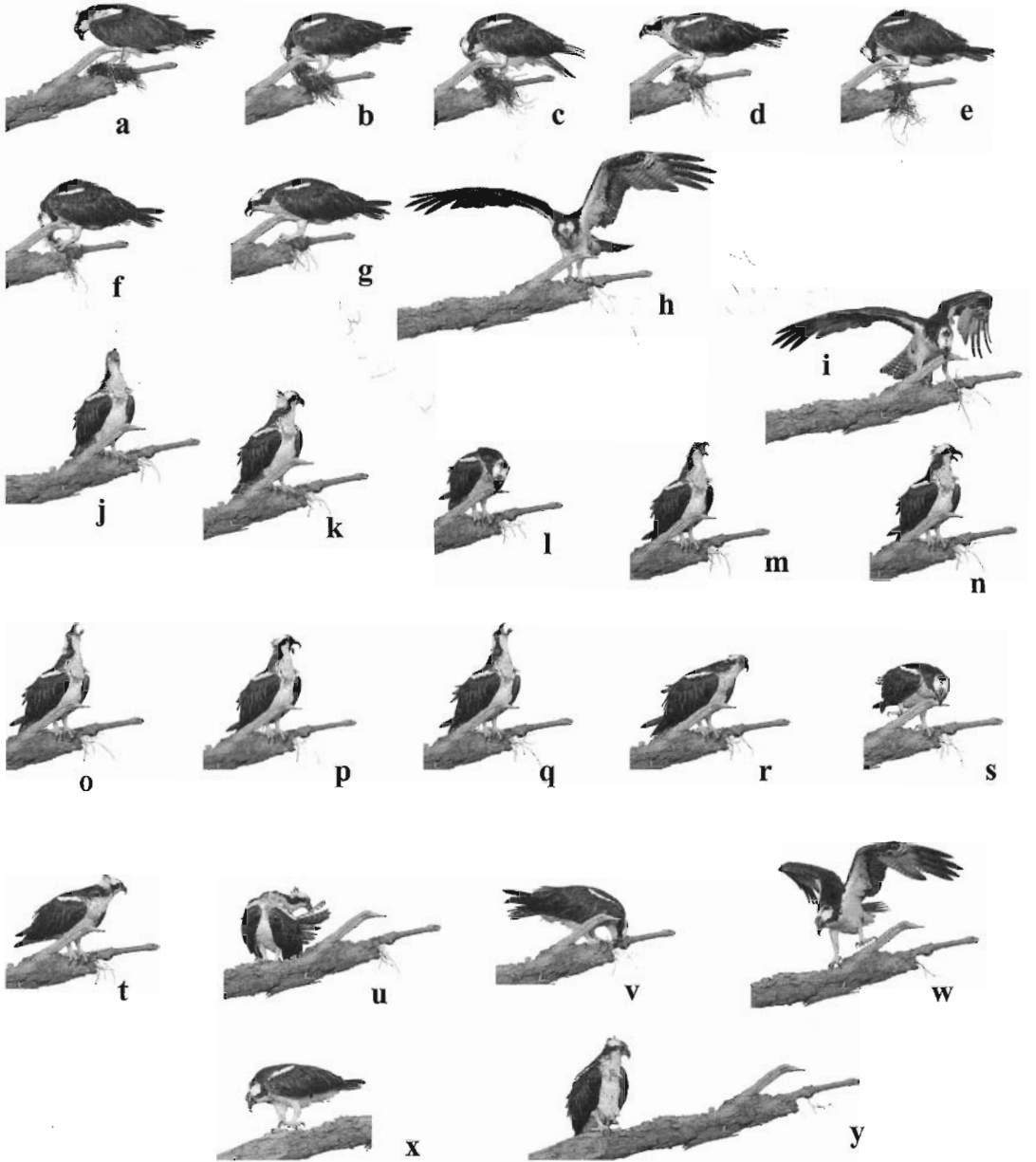


Figure 5. A composite photographic summary of an Osprey swallowing seagrass. Honeymoon Island State Park, Florida. 26 April 2008.

Selected frames, out of about 200 photos taken from 1840 h to 1849 h, are presented on one composite photo (Fig. 5).

*Striking Fish at a Low Angle to Avoid Contact with Sharp Tips of Fish Stiff Dorsal Spines*

Ospreys hunting fish were observed along the Texas coast during winter between 2005 and 2008.

After watching hundreds of dives of up 12 Ospreys fishing in the same place, I saw them plunging into the water feet-and-head first at a low angle, about 45°. Carpenteri (1997) described Ospreys plunging into water at a 45° angle to an almost horizontal position. I only observed Osprey plunging at about 45°, and the only time I saw them take the horizontal position was when the diving bird

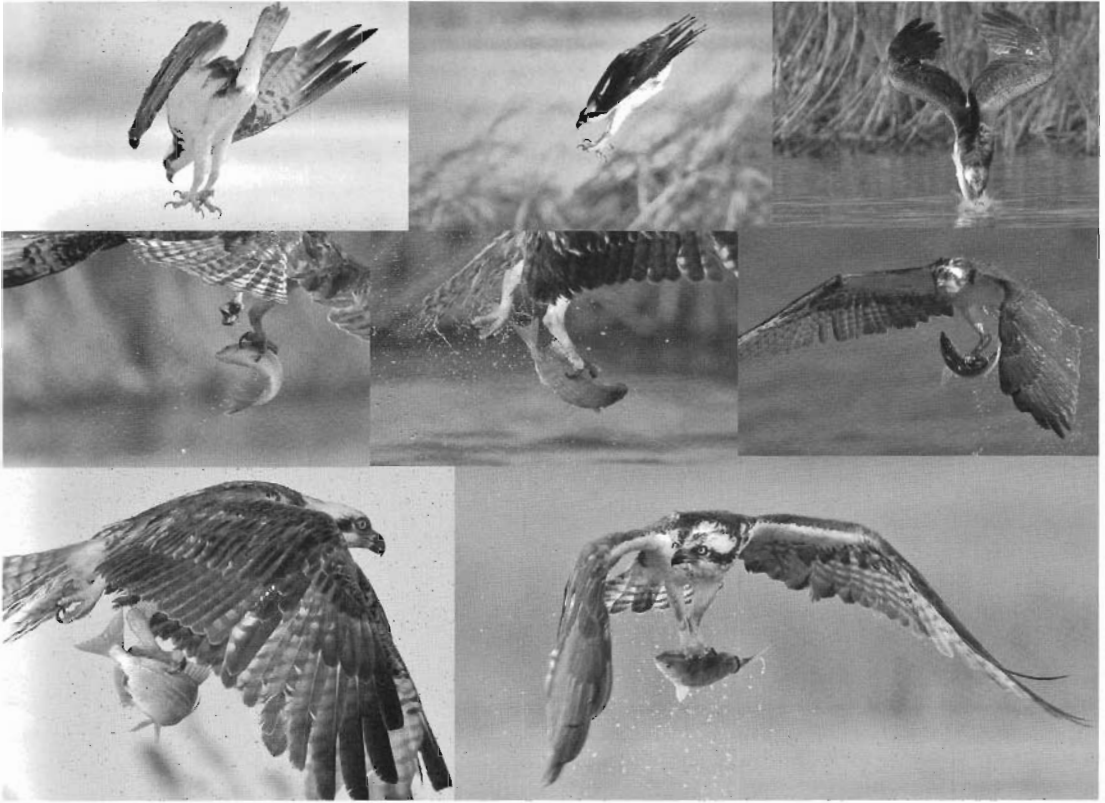


Figure 6. Composite photographs illustrating Osprey low angle strikes and position of feet right after the strike. Note the positions of the foot avoiding hard and sharp tips of pinfish dorsal spines. Freeport, Texas. Winter 2007.

aborted the dive just above the water. I observed Osprey foraging on fish with long, stiff and very sharp dorsal spines: pinfish (*Lagodon rhomboides*). In a tidal lake in Freeport, Ospreys during the winter fed on pinfish almost exclusively. I only saw one incident of an osprey taking a red drum (*Sciaenops ocellatus*), even when other fish were abundant in this spot. Small, finger-sized fish were taken only when Ospreys could not find larger sized fish. I began to pay more attention to find out how Ospreys avoided being speared by the stiff spines of pinfish. Any serious damage to the raptor's feet can have fatal consequences, because they depend on their feet for hunting and defense. From my field observations and analyzed photographs, it seems there is an important reason for Ospreys using an angle of about 45° when striking fish. Many fish have long, sharp spines in their dorsal fins protecting them from predators attacking directly from above. It seems Ospreys avoid being speared

by these spines by striking the fish from the unprotected lateral side. Normally, by striking at a low angle with claws spread and held in an almost vertical position, the Osprey's feet are avoiding contact with the sharp tips of spines and usually 2-3 talons grip the fish's unprotected lateral side. At the same moment one or two of the remaining talons strike the top of the fish, often through the base of the dorsal fin. It seems that the flexibility of the reversible outer toe might also be used for optimum effect in positioning the talons when striking the lateral side of the fish. In all cases, I observed that usually one foot was used to strike avoiding sharp spine tips. The second foot usually was used soon after emerging from the water to reposition the prey for air transport. Composite photographs (Fig. 6) show various stages of the dive including the Ospreys foot position right before the plunge, and position of the talons after the strike to grab the fish and bring the prey above the water.



Figure 7. The male Wings-Drooping-And-Shivering display when holding partially eaten fish in his talons. Honeymoon Island State Park, Florida. 26 April 2008.

*Hunting a Larger Prey with Small or Partially Eaten Fish Hold in the Talons*

When studying Osprey foraging during winter along the Texas coast, I observed on several occasions that after getting a small fish, some Ospreys continued flying slowly over the water and sometimes hovered and even dived toward another fish. On one occasion, when an Osprey was flying over the water with a small part of mostly eaten fish, he spotted a new fish. The bird hovered for a moment, dived and plunged into the water, and came out with a large-sized fish in its talons. The leftovers of the old fish were lost during the plunge into the water.

NOTES ON OTHER SELECTED BEHAVIORS

*Male Wings-Drooping-And-Shivering Display and Pre and Post-Copulatory Behaviors*

There is only one published record (Clancy 2006) of a male displaying in front of a female by drooping and then shaking and shivering his wings. Clancy (2006) observed this display when the pair landed on the nest after flying together. He did not mention the male lowering his head during the display. I Bull. Texas Ornith. Soc. 42(1-2): 2009

observed this display at Honeymoon Island once. The male came to the nest with a half eaten fish, but instead of offering the fish to the female (she was not begging for it) he turned backward to her, lowered his head, dropped his wings and kept shivering his wings for about 30 sec (Fig. 7). The male kept the fish in his claw throughout the entire display. There was neither a reaction from the female, nor did she show an interest in the food. After the male stopped displaying, he took flight with the fish remains in his talon and flew to a nearby perch, where he finished eating the fish.

The male Wings-Drooping-And-Shivering display observed at Honeymoon Island Osprey population is the second known record of this display for *Pandion* sp. and first record for *Pandion haliaetus* if *Pandion cristatus* is accepted as a separate species.

I only witnessed one attempt to copulate shortly after a male brought a partially eaten fish to a female. The male brought the fish to the nest and the female took it from him, flew to a perch on another tree and began to eat it. The male after a few minutes of standing on the nest joined her and perched close to her for another few minutes. Then he flew up and

landed on the female's back. The female allowed the male to land on her while still holding an uneaten part of the fish. For a few seconds the male tried to copulate but no cloacal contact was made during this attempt. All other copulation attempts I observed were not related to feedings.

#### *Notes on Osprey Feeding Behavior*

I had numerous opportunities to observe, in detail, the whole process of Ospreys eating fish from the beginning to the end, sometimes at a very close distance (6 to 10 m) to the dining bird. Perhaps, the most complete feedings I observed were several different incidents of Ospreys eating large specimens of the largemouth bass (*Micropterus salmoides*) taken from ponds between freshwater marshes on the upper Texas coast during winter. When Osprey eat large bass, the whole process can last an hour or longer. All parts of the fish were consumed except those that unintentionally fell. I did not observe the Osprey intentionally discarding any fish parts during eating. All Ospreys followed a typical sequence of fish consumption. They usually started with the tips of the fish mouth, consuming the jaws, then eyes, and opercula. Opercula and gills were eaten in fragments, only involuntarily dropped fragments were lost. Next the viscera were removed piece by piece. Large viscera parts from large fish very often fell to the ground when the Osprey tried unsuccessfully to swallow them. With one foot used to stand on the perch and the other one used to hold the prey, the Osprey had no way to tear small, bite-size pieces from the large fish viscera held in its bill. When trying to swallow large pieces of fish viscera or when making some effort with its bill to hold it, the bird usually lost the fish organs when it lost grip of them, and the viscera fell to the ground. Also, soft organs, like liver, etc., were smashed inside the bill and parts would fall to the ground. The next step was consumption of the rest of the fish's body, tearing off small pieces of flesh and bones. The tail was usually swallowed in one piece, if it did not accidentally fall to the ground. After consuming the last piece of fish, the Osprey usually spent some time picking small pieces of the fish stuck to its feet and cleaning its bill by wiping it against the branch or sometimes (observed in Honeymoon Island semi-colony) clean the inside of its mandibles by grabbing small ends of branches and rubbing the inside of its bill against the wood.

Selected frames illustrating Osprey consuming parts of largemouth bass are shown in composite photographs (Fig. 8).

#### *Ospreys Releasing Too Large Fish from Their Talons into the Water*

I observed several Ospreys catch and hold in their talons a large vigorously fighting fish. In some cases the fish was released back into the water after a few unsuccessful tries to get airborne with the prey in its talon. Sometimes the Osprey rested for a longer moment on the water with its wings spread above the water surface before getting ready for the next try to lift with its prey. Ospreys usually were able to lift to in the air with very large fish that did not fight but released large ones that did not stop fighting.

#### *Notes on Selected Osprey Comfort Movements*

I observed two interesting Osprey comfort movements during my field studies at Honeymoon Island State Park. I could not find any references in published data. One was the way Ospreys were cleaning their bills. The well-known behavior of rubbing their bill sideways against the branch was used very often but also, in many observed cases, another way of cleaning the bill was applied as well. To clean inside parts of the mandibles, Ospreys grabbed small ends of dead branches or small parts of wood sticking out from the tip of a broken end of the branch and rubbed both inside parts of their mandibles. Often their tongues would stick out allowing thorough cleaning inside the bill without a tongue in the way (Fig. 9).

The second interesting Osprey comfort movement was scratching the head. In most cases typical direct scratching using the talons was used but on one occasion I also noticed an Osprey scratching its head by rubbing it against a branch (Fig. 10).

I observed Ospreys dragging their feet in the water (sometimes 2 to 3 times in a row, one after another for several meters each time) at Honeymoon Island during hot afternoons. I did not observe this behavior during mornings. I did not observe this behavior in wintering Ospreys on the upper Texas coast.

## DISCUSSION

Despite the fact that the Osprey is such a well-studied species, its behaviors need more field studies in different locations and habitats for comparative



Figure 8. A composite photo of an Osprey eating a largemouth bass. Only large or soft tissue organs of viscera were involuntarily dropped. San Bernard National Wildlife Refuge, Texas. Winter 2007.



Figure 9. An Osprey cleaning the inside parts of his bill. Note the tongue sticking out on the side of the bill allowing thorough cleaning of the inside of the bill. Honeymoon Island State Park, Florida. 21 April 2008.



Figure 10. An Osprey scratching its head by rubbing it against the branch. Honeymoon Island State Park, Florida. 20 April 2008.

data. It was one of the key species in discovering effects caused by chlorinated hydrocarbons on eggshells (Poole 1989). Also, observation of Osprey migration especially using GPS and radio transmitters is another popular subject and one of the best studied aspects of Osprey life (del Hoyo et al. 1994, Dennis 2008). Perhaps, the most studied areas include breeding biology, ecology and behavior as many nests in different parts of the world are watched closely and often for extended periods of time (Poole 1985, Birkhead and Lessels 1988, Green and Krebs 1995, Rose 2000, Widen and Richardson 2000, Clancy 2005a, Dennis 2007). There is limited work on other Osprey behaviors (Bretagnolle and Thibault 1993); these authors studied Ospreys communicative behavior.

Osprey populations in many locations around the world, including those in the United States, are changing nesting behavior (Poole 1989), and Ospreys are also altering their aggressive behavior toward humans, who are either sharing or frequently visiting their nesting territories. These behavioral changes seem to show a trend towards Ospreys becoming less or non-aggressive toward humans visiting places with active nests. Allen (1892) reported this behavioral change on a privately owned island where a large Osprey semi-colony was protected from harassment. As a consequence of the Osprey's acceptance of humans' close presence in a growing number of places, nest observations are becoming a much easier task and allow data collection without disturbing nesting pairs. It also seems that Ospreys adapt quickly to habitat changes if nesting requirements and a fish supply are available. Ospreys readily accept artificial nest sites on human-made platforms. In Florida, it seems that these birds not only readily accept man-made nest structures, but some nesting pairs even favor platforms over natural trees and often leave their old nesting sites and move to urban areas to nest on platforms or utility posts with artificial nest structures (Poole 1989). In Florida, only a few decades ago, any attempt to photograph active Osprey nests in a remote location (like small islets not visited often by humans) were not only difficult but also dangerous to the photographer or observer as many Ospreys fiercely defended their nesting territories and often dived at visitors. As this aggressive behavior has changed due to habituation, now it is possible to spend time close to many active Osprey nests without disturbing the

pairs' or nestling's normal activities. Poole (1981) showed that human disturbance when visiting habituated Ospreys on their nesting sites had little or no affect on nesting success. On the other hand, human disturbance when visiting isolated colonies or nests can possibly have a negative impact on the nesting success (Poole 1981, Clancy 2006). In west-central Idaho van Daele and van Daele (1982) found Osprey nests located more than 1,500 m from human disturbance produced more offspring, yet the birds frequently nested close to humans and habituation to human activities appeared to vary depending on the frequency of disturbance. High nest failures and desertion of territories associated with increasing tourism and disturbance have been reported (Palma et al. 2004, Dennis 2007).

It is also possible that different populations may show some differences in behavior depending on the habitat where they court and nest. Because of such a broad worldwide distribution, Osprey populations need to be studied by many field researchers.

#### *Stick-Breaking-Off-And-Showing Display and Osprey Intraspecific Kleptoparasitism of Nesting Materials*

The courting behavior of a male breaking sticks off in front of his mate would be more likely to occur in natural habitats with ample trees available with dead branches of the right size for the Osprey to break. Individuals nesting in urban areas or on platforms in open areas might not have the opportunity to perform this type of courtship display because a lack of sticks to break off in close vicinity, lack of suitable perching places to present the stick to the female or both. The male bringing other nesting material, such as a clump of sea grass, between stick presentations was witnessed only once. During the full length display I observed the male did not bring any seagrass despite its availability on the shore in visible range of the female. More observations are needed to establish how often material, other than sticks, are used in the presenting display, but it is also possible that maybe some males prefer to present only sticks.

Kleptoparasitism of nesting materials might occur only in some Osprey semi-colonies where many nests are located relatively close to each other and there is a shortage of available nesting material. In places where another nest is located several kilometers away this behavior is probably non-existent. As I did not collect any information

Documenting the final purpose of pirated nesting material, this behavior needs more study. There could be two reasons for this behavior: using pirated material for building one's nest or bringing it to the mate during the Stick-Breaking-Off-And-Presenting display. The latter reason could explain an incident I observed one time when the male brought 2 sticks (collected outside of visible area) in his talons and present them to his mate.

Questions can be raised and argued about possible benefits of the female sitting and guarding the nest during the nest construction before eggs are laid. This behavior of nest material kleptoparasitism, at least practiced by some Ospreys, gives a good reason for the need to guard the nest by a nesting pair at all times. Without full-time protection during a nesting activity period, nests can be damaged quickly and the process of repairing can become a never-ending task. I also observed a few cases when a single male left his nest (nest construction was in the beginning stage) to feed or to look for more nesting material, another male came to steal sticks from his nest. I only observed Ospreys stealing material from occupied nests and never from old aborted ones.

Also, at the Honeymoon Island semi-colony, I observed Ospreys only collecting sticks by either breaking them off from pine trees or by stealing them from other nests in the colony. There are many observations published on Osprey methods used to gather nesting material, but the reports often differ from each other on what is the preferred method. Poole (2001) suggested Ospreys often snatch sticks from the ground rather than break them off from trees. Stinson (1976) observed that an Osprey pair carried a substantial portion of the sticks to the nest that were pulled directly from trees. Kennard and Kennard (2006) reported an Osprey pair only collected sticks from trees during the first stages of nest building and when maintaining an existing nest. It seems that some Osprey behaviors, including gathering nest materials, vary in different habitats and locations. The sticks for nest construction and lining materials vary depending on locally available materials (Poole 1989, Clancy 2006). Despite many sticks lying around, I never saw any Osprey at Honeymoon Island colony trying to pick them up from the ground.

It is unlikely that any behavior observed inside the Honeymoon Island Osprey semi-colony is unique and restricted only to this population. Questions can be raised as to why in so many long-term

observations of courting and nesting Ospreys no one has ever observed and reported similar behaviors. Granted, some long-term observations were done on single nests (Birkhead and Lessels 1988, Rose 2000). Perhaps the Stick-Breaking-Off-And-Presenting display is not performed in remote places during the observers' presence that may have disturbed normal Osprey activities. Also, it is possible that this courting display is only practiced by males trying to get a new mate or ones from freshly formed pairs. Studies on large Osprey nesting semi-colonies in the past (Allen 1892, Abbott 1911) were in areas occupied by migrating populations, but no similar observations were reported. It is possible that some behaviors are restricted only to non-migrating individuals living year round in one area and courtship can occur during extended periods without having time restrictions of migrating individuals who have limited time together before females start to lay eggs.

There is a description indicating that the Stick-Breaking-Off-And-Presenting display may have been observed in the past but possibly only partly witnessed by an observer. Rose (2000) described an incident that could have been a single stick presenting event. Text taken from his paper: "*The male then flew to a dead tree, seized a stick, while fluttering, flew past the other bird, then circled. He settled briefly in the nest-tree then on the top nest, then flew out of sight with the stick*". Some single events I observed several times before witnessing repeated displays were similar to this although no male brought sticks to the nest.

#### *Swallowing Seagrass by Osprey*

I do not have any definite explanation for the behavior of swallowing seagrass by an Osprey. This behavior needs more study in the future. I was not able to make a positive identification of the swallowed seagrass blades. Most likely it was manatee grass (*Syringodium filiforme*) blades that were swallowed. This clump had a few fragments of turtle grass (*Thalassia testudinum*), but I did not notice the wide blades inside the Osprey's bill when it was taking bites. Grass was found sometimes as part of regurgitated material during the process of casting a pellet by some Ospreys (Poole 1989) but this author makes a note that grass must have been ingested accidentally. As I observed the Osprey intentionally swallowing a few bites of seagrass and forcing it down the throat, it seemed to be a possibility that these birds might need, at least

sometimes, grassy material to help them in the process of regurgitation of some pellets. Casting pellets by Ospreys is a well-documented behavior but it is not observed often and pellets are usually very small (Poole 1989). I only witnessed an Osprey casting a small pellet once despite countless hours of observation. In the observed case of casting a pellet, the process starts with a similar posture and movements that the Osprey took after swallowing seagrass: erected neck, head pointing upward with an open bill. The pellet was cast with the head down forcing a small pellet out. Even then, the Osprey, after swallowing mouthfuls of seagrass took a similar posture with its head up and bill wide open but did not lower its head down and I did not notice any pellet being cast out.

*Striking Fish at a Low Angle to Avoid Contact with Sharp Tips of Fish Stiff Dorsal Spines*

My suggestion about the possibility of Ospreys using a low angle to strike a fish to avoid possible damage to its feet by the stiff spines of a dorsal fin of some fish species needs to be confirmed by more field observations. There are published records of an Osprey possibly taking a substantial number of triggerfish (*Balistidae*) and surgeonfish (*Acanthuridae*) (Smith 1985) and porcupinefish (*Dicotylichthys* sp.) (Savory 1989) although these records are based on remains found around the feeding perches (Smith 1985) or under a nest (Savory 1989) and not an actual observation of an Osprey taking those species alive in the water. Some prey 'middens' found around feeding perches contained a large percentage of small birds identified as terns *Sterna* spp. (Smith 1985), but these data need verification by further studies. Marchant and Higgins (1993) assumed that Ospreys are able to avoid sharp spines present on these fishes but did not offer any suggestion as to how it is done. More data collected from different places on an Osprey's final strike on different fish species equipped with stiff sharp dorsal spines will help to find out if a low angle attack is always applied and if it is useful to protect the Osprey's feet. Comprehensive observation is also needed to determine what technique is used to avoid the sharp lateral spines located on the caudal peduncle of surgeonfish, if indeed these fish are taken. I did not find any other references confirming that Osprey prey on triggerfish or surgeonfish.

The behavior of striking every fish near the water surface at a low angle seems to be a very safe

way of attack without taking chances of a possible misjudgment in case a prey has stiff dorsal spines. Avoiding the stiff, sharp dorsal spines is probably one of multiple benefits in using a low angle to strike a fish. Tucker (2001) suggested that because of more acute sideways vision, raptors might favor a spiral flight path when approaching the prey. No studies were done on Osprey's attacking flight paths and estimating the position of the attacked fish in an Osprey's field of view can be very difficult, if not impossible, to follow as the fish's movement and position are usually not visible to the observer. Analysis of all my photographs and my close observations show that Ospreys, after submerging into the water will come back above water in the following sequence. First, the tips of the wings, then part of the wings will come above the water surface followed by the head. When the bird's wings, head and breast are above the surface, the Osprey will shake its head, removing most of the water from it. Only sometimes will it rest for a moment lowering its wings and partially submerging them into the water but, usually it will try to get airborne right after coming out of the water. Its feet, with or without prey, emerge above the surface when the bird is practically airborne. I observed only one exception. In one instance I collected an interesting photograph taken after a shallow unsuccessful plunge. The Ospreys feet, talons closed, were in a horizontal position and lifted above the water at the same time as the whole body (Fig. 11). This leg position suggests that the Osprey possibly tried to strike the fish's lateral side when holding its feet at a horizontal position. The Osprey plunged with its feet held out at about a 45° angle so it had to raise them to a horizontal position right under the water surface and probably by not hitting the target the feet went above the water surface in this position.

All my field observations indicate that Ospreys are most likely depending on visual contact with the fish during the final dive and plunge to strike the prey. In the last moment before the plunge, just above the water, the Osprey places its head with an extended neck right behind its claws while trying to keep visual contact with its prey at the moment of plunging into the water. Most authors call this feet-first plunge (Palmer 1988, Poole 1989, Marchant and Higgins 1993, del Hoyo 1994). Sibley (2001) used the name head-and-feet-first. Personally, I think the term feet-and-head-first should be used as that name describes the position during the plunge more precisely.



Figure 11. An Osprey coming out of the water after an unsuccessful shallow dive. Note the horizontal position of the legs. Freeport, Texas. Winter 2007.

#### *Hunting a Larger Prey with Small or Partially Eaten Fish Hold in the Talons*

The success rate for hunting Osprey varies (Swenson 1978, Swenson 1979, Edwards 1988, Poole 1989), and many factors have to be taken under consideration: individual experience and skills, weather conditions and most importantly seasonal availability of the fish (Ueoka and Koplín 1973, Dunstan 1974, Grubb 1977, Edwards 1988). I could not find any references about Ospreys searching for new prey before completely consuming the one already caught or right after catching a small one. During my observations, I noticed numerous Ospreys trying to find and hunt large fish in spots where they had successfully fished before, but after many unsuccessful dives or when they could not locate a prey, they left the place and went to small shallow tidal lakes with ample finger-sized fish. In all observed cases, Ospreys did that only after spending longer time in places where they usually were able to get a bigger prey.

#### *Male Wings-Drooping-And-Shivering Display and Pre and Post-Copulatory Behaviors*

The Osprey male Wings-Drooping-And-Shivering display observed at the Honeymoon Island semi-

colony is the second documented record of this male behavior. Palmer (1988) described precopulatory behavior as: "Females were on the nest rims and facing away from the males on the nests. Each male partly extended his wings and lowered his head for 5–7 sec. Then he flew, immediately turned, and hovered over the female. The male then alighted on the back of the female and remained there 7–10 sec." Although my observation seems to be the most complete display observed (lowering head, drooping and shivering wings plus holding fish in talons), this event did not end with copulation. Clancy (2006) also did not observe copulation after the male performed this display. More observations are needed to classify the Wings-Drooping-And-Shivering display as a possible precopulatory behavior. In the case observed by me, not only was copulation not attempted, but the female did not beg or show interest in the fish remains the male had brought to the nest. The female was fed earlier so she should not have been hungry at this moment, and the male reaction could have been triggered by her lack of interest in the food he brought.

Even though Osprey copulatory behavior has been intensively studied and collected data is extremely comprehensive (Birkhead and Lessels 1988, Poole

1989, Green and Krebs 1995, Widén and Richardson 2000), it mostly includes information on time periods, frequency, ratio between copulation attempts with and without cloacal contact, and analysis of observations regarding the question whether the female Osprey is trading food for sex or not. There are limited data published on the pre or postcopulatory behaviors of these birds. Studies done on the possibility of trading copulation for food suggest that Osprey females do not practice this behavior (Birkhead and Lessels 1988, Green and Krebs 1995, Widén and Richardson 2000), although Poole (1985) described the case when a poorly fed female traded food for sex with other males who offered her fish when she begged.

Birkhead and Lessels (1988) observed Ospreys copulate frequently, an average of 160 times per clutch, range: 88-338, starting 14 d before, and peaking a few days before the start of egg laying. According to this study, pairs averaged a rather low number of successful copulations per clutch: 59 (39%), range 20-97 (15.1-63.8%). Similar success rates of copulations were recorded by other authors for this species (46.5%, Levenson 1979; 47%, Poole 1985; 64% in low density and 69% in high density area, Widén and Richardson 2000). Also Birkhead and Lessels (1988) argued frequent copulation of male Ospreys include protecting their paternity by frequent copulation and by maximizing their time with the female when she is most fertile. At Honeymoon Island, I observed the copulation attempts between a male and female on the nest in the beginning stage. This may suggest that copulation attempts, even if unsuccessful, can possibly play a role in helping build a social bond between the newly formed pair, and frequent copulation attempts may help to maintain this bond later. Widén and Richardson (2000) summarized arguments about the social bond hypothesis and suggested that the fertilization and the predation hypotheses cannot explain differences in copulation frequency between the high and low density Osprey populations. More field observations of copulatory behavior, its frequency and seasonal periods should be studied within residential Osprey populations to compare copulatory behavior of migrating pairs that have a limited time on the nest together before the female is ready to start laying eggs.

#### *Notes on Osprey Feeding Behavior*

There are many studies on Osprey hunting and feeding behaviors (Swenson 1979, Poole 1985,

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Edwards 1988, Poole 1989, McLean 1991, Silva e Silva and Olmos 2002, Clancy 2005a, b) including an example of handling dangerous prey (Forbes 1989). Detailed descriptions of the process of consuming fish have been also published (Silva e Silva and Olmos 2002, Clancy 2005a, Kennard and Kennard 2006).

In general, my observations are very similar to those already recorded about the Ospreys eating sequence, but there were some differences. Ospreys did not discarding the viscera of the fish voluntarily and swallowed most of the opercula and gills, if these parts did not accidentally fall to the ground. Clancy (2005a) reported that some Ospreys consumed the fish viscera and some did not, but he did not specify the sizes of the fish. He also suggested a possibility of gut contents or a bird's degree of hunger as a factor of eating fish viscera. Olsen (1995) offered similar suggestions but neither of these authors offered specific suggestions of what gut contents attract raptors to eat it. Silva e Silva and Olmos (2002) reported opercula, gills and viscera of all mullets discarded during eating. During my observations in Honeymoon Island, where mullets were an important part of the Osprey diet, I did not notice the discarding of any parts of these fish by Ospreys, but I never had an opportunity to observe the complete eating process at a very close distance. Kennard and Kennard (2006) observations agreed with mine that the Osprey consume the whole fish including viscera, gills and opercula.

#### *Ospreys Releasing Too Large Fish from Their Talons into the Water*

In some publications, especially early ones (Abbot 1911, Bent 1937) and also in popular articles and on various Internet sites, one can find anecdotal information on a drowning Osprey that locked its talons into a very large fish and was unable to release the prey. Poole (1989) and Dennis (2008) both disagree with those stories of the Osprey not being able to open its talons in the water after locking them on the prey. My observations fully support their view.

#### *Notes on Selected Osprey Comfort Movements*

Comfort movements utilized by Osprey are not described in great detail in most of the available literature. Poole (1989) and Poole et al. (2001) only discussed this subject in general terms and did not list many details or references. Probably many comfort movements like the inside of the

bill cleaning technique or the rubbing of a head against the branch were simply overlooked by many observers.

The Osprey behavior of dragging the feet in water has a few possible explanations (Abbott 1911, Clark and Wheeler 2001, Poole 2002 et al.); this practice has usually been associated with cleaning feet or cooling. Dunstan (1974) described Osprey's short flights along emergent vegetation while dragging their feet for 2 to 10 m before returning to the hunting perch as a fishing method but this suggestion should be verified by more field data. I only observed Ospreys dragging their feet in the water during hot days in Florida (not related to hunting), but I never observed Ospreys practicing this behavior during the winter in Texas, even during warm days. My observations suggest that cleaning the feet might not be a primary purpose, but could be an additional benefit. Practicing this behavior during the hot part of the day supports thermoregulation.

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