Call, R., and D. Shutler. 2022. Risky foraging by Ring-billed Gulls (*Larus delawarensis*). Journal of Field Ornithology 93(3):4. [online]
URL: https://doi.org/10.5751/JFO-00172-930304

*Avian Behavior, Ecology, and Evolution*

# Risky foraging by Ring-billed Gulls (*Larus delawarensis*)

## Forrajeo riesgoso por *Larus delawerensis*

*Ryan Call*[1] *and Dave Shutler*[2]

ABSTRACT. Organisms escape consumers using a variety of behaviors and structural or physiological defenses (e.g., toxins and irritants). Portuguese men o' war (*Physalia physalis*) rely on nematocysts to immobilize or kill their prey, chiefly fish, but the nematocysts can also be painful or deadly to predators. Consequently, few species are known to approach, let alone consume, *P. physalis*. During an opportunistic birding excursion in coastal Texas, ~5 Ring-billed Gulls (*Larus delawarensis*) were observed picking up beached *P. physalis*, taking them to the water's edge, and thrashing them in the water briefly before consuming them, or at least parts of them. These are among a very limited number of records of birds consuming *P. physalis*.

RESUMEN. Los organismos escapan de los consumidores usando una variedad de comportamientos y defensas estructurales o fisiológicas (e.g. toxinas y agentes irritantes). *Physalia physalis* utiliza nematocistos para matar o inmovilizar sus presas, principalmente peces, pero los nematocistos pueden ser también dolorosos o mortales para los depredadores. Consecuentemente, se conocen pocas especies que se acercan y menos consumen *P. physalis*. Durante una excursión oportunista de observación de aves en la costa de Texas, observamos aproximadamente cinco individuos de *Larus delawerensis* recogiendo individuos de *P. physalis* que habían sido arrastrados hacia la playa, llevándolos al borde del agua y golpeándolos contra el agua antes de consumirlos o al menos consumir partes de ellos. Estos registros entran dentro de un número muy limitado de registros de aves consumiendo *P. physalis*.

Key Words: *Larus delawarensis; nematocysts; Physalia physalis*

### INTRODUCTION

Darwinian fitness is predicated largely on consuming without being consumed. Accordingly, myriad adaptations to both capture prey and to defend against predators have been described. For example, monarch butterflies (*Danaus plexippus*) sequester cardiac glycosides obtained from milkweeds (*Asclepias* spp.) that make both unpalatable to most consumers. Many species, including monarchs, advertise their unpalatability using warning (aposematic) coloration (e.g., Brower et al. 1967, 1968). The monarch system shares many similarities with other systems that pair warning coloration with unpalatability or other risks.

Defenses can sometimes also serve as offenses; Portuguese men o' war (Phylum Cnidaria, Class Hydrozoa, Order Siphonophorae, *Physalia physalis*) are colonial organisms (distinct from jellyfish in the cnidarian classes Scyphozoa, Cubozoa, Staurozoa, and other orders in Hydrozoa) that feed mainly on fish that they immobilize or kill with nematocysts from their tentacles (Lane 1960, Elston 2007, Hetherington et al. 2022). These nematocysts are also effective in self-defense; they can cause intense pain in humans (Haddad et al. 2002, Labadie et al. 2012), and on rare occasions, even death (Burnett and Gable 1989, Stein et al. 1989). Thus, not surprisingly, most organisms are assumed to avoid *P. physalis* (Lane 1960). Exceptions include a few species of mollusks, crabs, and turtles (Bingham and Albertson 1974, Da Silva and Brown 1984, Arai 2005, Munro et al. 2019, Nascimento et al. 2022). Part of many organisms' avoidance of beached *P. physalis* might be ascribed to the latter's bright blue warning coloration, although this cnidarian's distinctive appearance and presentation in other sensory modalities may contribute. In any case, because they are rapidly digested (Ates 1991), consumption of *P. physalis* and other cnidarians is probably dramatically underestimated when gut contents of potential predators, such as fish and birds, are examined (Harrison 1984, Arai 2005, Hays et al. 2018) and compared to data from molecular sampling methods (Cardona et al. 2012, McInnes et al. 2017). Therefore, there is interest in better documenting how *P. physalis* and other cnidarians participate in food webs (Ates 1991, Hays et al. 2018, Thiebot and McInnes 2020, Hetherington et al. 2022). We report here on observations of Ring-billed Gulls (*Larus delawarensis*) feeding on beached *P. physalis*, a trophic interaction that may be under-appreciated.

### METHODS AND RESULTS

At 10:07 on 30 Dec 2021, the senior author was walking southwest along the waterline and birdwatching at Bermuda Beach in Galveston, Texas, USA (29.215 N, -94.915 E). It was partly cloudy, 26 °C, with an 11-kph steady ESE wind. Approximately 0.6 km into the walk, he noticed a group of ~5 Ring-billed Gulls foraging in the wrack; the small flock foraged in an approximately 15- × 15-m section of the shore, moving into the surf and rarely going above the strandline. All gulls were adult in unremarkable definitive basic plumage, and he saw no clear evidence that they were unhealthy, although this would be difficult to judge without handling them. Closer scrutiny revealed that the birds were foraging for beached *P. physalis* (Fig. 1; also see Burke 2021), of which approximately 500–750 colonies littered the 0.6-km stretch of beach covered. The gulls grabbed beached *P. physalis* and thrashed them in the water at the shore before consuming them (Fig. 2). The gulls were observed ~10 min in that small section of shore; during that time, the gulls consumed at least 10 *P. physalis*, though we note that they likely took more colonies without being observed. Additionally, when the senior author turned to leave, the gulls continued foraging.

[1]The Kinkaid School, [2]Acadia University

**Fig. 1**. Ring-billed Gull (*Larus delawarensis*) with a small Portuguese man o' war (*Physalia physalis*) in its bill.

**Fig. 2**. Ring-billed Gull (*Larus delawarensis*) at the shore perhaps trying to trigger nematocysts to fire to make a Portuguese man o' war (*Physalia physalis*) less risky to consume.

In addition to observing and taking notes, the senior author took a series of ~90 images and a video (https://drive.google.com/drive/folders/1FQfVRp1-eX5q06nFETI0PY2cywiQi_G6?usp=sharing; the video is the last file in this drive). It appeared that average-sized *P. physalis* were more likely than larger colonies to be selected; there are at least two large colonies that are avoided by two different birds in the video (at 00:26 and 03:13; note that the second bird briefly thrashes the large colony before moving on). It appears that the gulls fed mostly on *P. physalis* gas-filled floats (pneumatophores) and that thrashing appeared to dislodge the tentacles before feeding. The colonies consumed generally had pneumatophores similarly to the size and length of each bird's beak (see Pistorius et al. 2020). At 01:21, a gull shakes a beached *P. physalis*, and when the bird runs to the surf, there are no visible tentacles dragging in the sand. Similarly, at 02:01, a gull shakes a *P. physalis* until the tentacles break off, albeit imperfectly, because this particular gull struggled to clear the tentacles during the 56 sec it was followed in the video. The gull at 01:21 selects a colony and completes the entire process of thrashing, cleaning, and consuming in 100 sec (the same bird, while it appears off screen for 2 min, reappears at 03:21 with seawater dripping from its bill). Based on how quickly other birds consumed beached *P. physalis* (the very first bird in the video appears to finish thrashing at 00:38 and consumes a colony 4 sec later), we suspect that the individual bird at 01:21 devoted between 90 to 96% of its time to thrashing and preparing a colony for consumption. However, allocation of time between preparing *P. physalis* and consuming is estimated based on imperfect video and only applicable to one gull. Not surprisingly, gulls varied in time spent preparing and consuming *P. physalis*, likely dependent on the size, shape, and integrity of colonies as well as individual gulls' abilities to handle the prey. Generally, the majority of the time spent by gulls was devoted to thrashing and preparing *P. physalis* for consumption. There were no observations of kleptoparasitism. Last, we note that these observations were opportunistic, and their import was unknown at the time they were made; therefore, a systematic approach was not taken to collect more data.

Other sympatric charadriiforms, including 10 Laughing Gulls (*Leucophaeus atricilla*) 0.6 km northeast up the beach, a Lesser Black-backed Gull (*Larus fuscus*) further southwest, and shorebirds, including a solitary Willet, *Tringa semipalmata*, numerous plovers, and Sanderlings, *Calidris alba* (one of which can be seen in the video), were not observed consuming *P. physalis*. Three Great-tailed Grackles (*Quiscalus mexicanus*) remained in dunes adjacent to the beach. Finally, ~5 other Ring-billed Gulls observed flying overhead to the northeast did not engage in the same behavior, despite the ubiquitous presence of beached *P. physalis*.

Because the images are suggestive, but perhaps not definitive, we emailed two to Dr. Peter Schuchert, Muséum d'histoire naturelle, Geneva, an authority on cnidarians, without telling him what species the gulls had in their bills. He concluded *P. physalis*, but cautioned that his identification was suspicious because the species rarely comes into temperate waters, from whence the junior author's request originated, as opposed to Texas, where the senior author's observations were made. Thus, we are confident that the gulls were indeed consuming *P. physalis*.

## DISCUSSION

We found few other reports of birds consuming *P. physalis*. Phillips et al. (1969:709) had two sentences in a 10-page publication mostly devoted to fish-cnidarian associations: "… shore birds scavenge among the remains of *Physalia* … stranded on beaches …. The gastrozoids and tentacles of *Physalia* are eaten along with entangled food organisms." Phillips et al. (1969) did not identify the species of shore bird, and from the above quote, it is also not clear whether the species was (were) birds found along the shore, or members of a shorebird taxon (Order Charadriiformes, Suborder Charadrii). Pitman and Ballance (1990) reported that "[Leach's Storm-Petrels, *Hydrobates leucorhous*] that we collected in the tropics occasionally had *Physalia* tentacles draping from their beaks and it is possible that instead of eating *Physalia* they were actually stealing *Physalia* prey." Cherel and Klages (1998) concluded that evidence was at best suggestive that Wandering Albatrosses (*Diomedea exulans*) may include *P. physalis* in their diet (their Appendix 5). Finally, L. Lefebvre (*personal communication*) had not come across

*Physalia*-feeding by birds in his many reviews of literature on novelty in foraging behaviors (e.g., Lefebvre et al. 2016).

The violent thrashing of *P. physalis* by the gulls appeared to be to get rid of the tentacles (technically, tentacular palpons; Munro et al. 2019) where the nematocysts are located, or it may be to cause nematocysts to fire harmlessly, making consumption less risky. Selective feeding on parts of cnidarians has been reported elsewhere (Byrkjedal and Langhelle 2019). Our limited evidence leans toward shedding tentacles over stimulating firing of nematocysts. Analogously, bee-eaters (Meropidae) often wipe hymenopteran prey against substrates to remove potentially harmful stingers or to purge venom (Fry 1969). However, in contrast to our observations, Phillips et al. (1969) stated that tentacles were consumed. Clearly, further observations are needed.

Different tissues will have different sensitivities to nematocysts. Bills and other keratinous tissues are likely impervious to them, whereas soft tissues such as the skin and gut are likely highly sensitive (Munro et al. 2019). Thus, birds and other organisms will likely avoid risks of *P. physalis* stings by ensuring that nematocysts have been disposed of or inactivated before any part of a cnidarian is consumed. Some acids, such as vinegar, have been suggested as having soothing properties for humans that have been stung, possibly because it inhibits discharges of nematocysts, although there is not strong consensus on this remedy (Elston 2007).

If our observations of Ring-billed Gulls consuming *P. physalis* document a relatively novel behavior, it may have arisen from increased frequency of beaching of *P. physalis* (e.g., Headlam et al. 2020), in which case there may be multiple independent and spontaneous adoptions of the tactic. Alternatively, we may have chanced upon the nucleus of a novel behavior that may be eventually spread culturally, such as occurred with passerines in Europe learning to puncture foil caps on milk bottles to get at cream (Lefebvre 1995). However, unlike consuming cream from a milk bottle, consuming *P. physalis* almost certainly entails greater risks. Thus, kinetics of the spread of consumption of *P. physalis* may be much slower, if they unfold at all. Ring-billed Gulls and their congeners are opportunistic feeders (Pollet et al. 2020), so eating *P. physalis* may simply be a manifestation of taking advantage of what is available, which would make the behavior merely haphazard. Although, if feeding on *P. physalis* is not novel for birds, it is curious that it has so seldom been documented. Our observations also fail to tell us how the gulls determined that a vigorous wash would render *P. physalis* worth consuming. One possibility is that innate or learned behaviors associated with consuming a range of other cnidarians provided them with an appropriate starting repertoire.

The net energetic benefit of consuming cnidarians has likely been underestimated, because most species are easily captured and frequently aggregate, so large quantities can be consumed in short order and with minimal energetic expenditure (Ates et al. 1991, Arai 2005, Phillips et al. 2017, Hays et al. 2018, but see Theibot and McInnes 2020). It is thus probably not surprising that a range of marine predators consume cnidarians (and possibly the prey the latter have captured; Harrison 1984, Pitman and Ballance 1990) even when they are not aggregated. Thus, one could ask why more species on the beach, such as Laughing Gulls, did not join in, because, moreover, the prey items were immobile so that capture costs would be negligible. On the other hand, *P. physalis* may not be as profitable as other cnidarians, partly because less of the former's tissue contains energy-rich gonads, and partly because the gulls appeared to mostly consume pneumatophores, which are even less energy-dense than the other colony parts that live below the water surface (Munro et al. 2019). In addition, we saw no evidence that gulls were taking advantage of *P. physalis* prey that may have been trapped in their tentacles when they beached. Finally, the absence of kleptoparasitism, which is common in gulls (e.g., Pollet et al. 2020), could be attributable to risks of injury during contests coupled with a high density of prey that tipped the energetic balance toward directly capturing prey.

The observation that average-sized *P. physalis* were preferred over larger colonies suggests that risks were proportional to prey size because presumably energetic benefits of larger prey would be greater. Alternatively, average-sized colonies may be easier than larger colonies for gulls to prepare for consumption. If risks factor into choices, they may be a function of *P. physalis* maturation of nematocysts or sheer density of nematocysts. This warrants further investigation.

It seems unlikely that Ring-billed Gulls possess novel adaptations against *P. physalis* nematocysts, although we cannot exclude that possibility. Numerous bird species consume other cnidarians (Harrison 1984, Arai 2005, Thiebot and McInnes 2020), and evidence of additional avian consumers continues to be added (Melville 2013, Gerwing et al. 2016, Thiebot et al. 2016, Valenti 2016, Hetherington et al. 2022). It is likely that substantially more evidence of consumption of cnidarians by other bird species will be forthcoming as researchers take advantage of new molecular techniques such as next-generation sequencing (Gerwing et al. 2016, Hays et al. 2018), either of fecal or gut content genomes. Whether that evidence will include *P. physalis* remains to be seen. Either way, the importance of *P. physalis* and other cnidarians in food webs remains poorly understood (Hays et al. 2018, Hetherington et al. 2022).

*Responses to this article can be read online at:*
https://journal.afonet.org/issues/responses.php/172

**Acknowledgments:**

*We thank an anonymous reviewer for their extremely helpful and thorough suggestions that significantly improved our manuscript, Dr. Yves Cherel, French National Centre for Scientific Research, for providing a reprint, Dr. Peter Schuchert for confirming that he could identify P. physalis from the images, and Dr. Louis Lefebvre, Department of Biology, McGill University for some relevant and obscure references about birds consuming cnidarians and for informing us that he had not heard of this behavior with respect to P. physalia.*

**Data Availability:**

*Data/code sharing is not necessarily applicable to this article because no data/code were analyzed in this study. I do have ~90 images of RBGU consuming Physalia physalis here: https://drive.*

*google.com/drive/folders/1FQfVRp1-eX5q06nFETI0PY2cywiQi_G6?usp=sharing*.

## LITERATURE CITED

Arai, M. N. 2005. Predation on pelagic coelenterates: a review. Journal of the Marine Biological Association of the United Kingdom 85:523-536. https://doi.org/10.1017/S0025315405011458

Ates, R. M. L. 1991. Predation on Cnidaria by vertebrates other than fishes. Hydrobiologia 216:305-307. https://doi.org/10.1007/BF00026479

Bingham, F. O., and H. D. Albertson. 1974. Observations on beach strandings of the *Physalia* (Portuguese-man-of-war) community. Veliger 17:220-224.

Brower, L. P., W. N. Ryerson, L. L. Coppinger, and S. C. Glazier. 1968. Ecological chemistry and the palatability spectrum. Science 161:1349-1350. https://doi.org/10.1126/science.161.3848.1349

Brower, L. P., J. Van Brower, and J. M. Corvino. 1967. Plant poisons in a terrestrial food chain. Proceedings of the National Academy of Sciences of the United States of America 57:893-898. https://doi.org/10.1073/pnas.57.4.893

Burke, D. 2021. Portuguese man o' war have returned to Galveston beaches. Houston Chronicle, 30 December. https://archive.fo/z6KPo

Burnett, J. W., and W. D. Gable. 1989. Fatal jellyfish envenomation by the Portuguese man-of-war. Toxicon 27:823-824. https://doi.org/10.1016/0041-0101(89)90050-0

Byrkjedal, I., and G. Langhelle. 2019. Selective feeding on jellyfish organs by Northern Fulmars *Fulmarus glacialis*. Ornis Norvegica 42:15-18. https://doi.org/10.15845/on.v42i0.1493

Cardona, L., I. Álvarez de Quevedo, A. Borrell, and A. Aguilar. 2012. Massive consumption of gelatinous plankton by Mediterranean apex predators. PLoS ONE 7:e31329. https://doi.org/10.1371/journal.pone.0031329

Cherel, Y., and N. Klages. 1998. A review of the food of albatrosses. Pages 113-136 in G. Robertson and R. Gales, editors. Albatross biology and conservation. Surrey Beatty & Sons.

Da Silva, F. M., and A. C. Brown. 1984. The gardens of the sandy-beach whelk *Bullia digitalis* (Dillwyn). Journal of Molluscan Studies 50:64-65.

Elston, D. M. 2007. Aquatic antagonists: Portuguese man-of-war (*Physalia physalis*). Cutis 8:186-188.

Fry, C. H. 1969. The recognition and treatment of venomous and non-venomous insects by small bee-eaters. Ibis 111:23-29. https://doi.org/10.1111/j.1474-919X.1969.tb01601.x

Gerwing, T. G., J. J. Kim, D. J. Hamilton, M. A. Barbeau, and J. A. Addison. 2016. Diet reconstruction using next-generation sequencing increases the known ecosystem usage by a shorebird. Auk 133:168-177. https://doi.org/10.1642/AUK-15-176.1

Haddad, V. Jr., F. L. da Silveira, J. L. Cardoso, and A. C. Morandini. 2002. A report of 49 cases of cnidarian envenoming from southeastern Brazilian coastal waters. Toxicon 40:1445-1450. https://doi.org/10.1016/S0041-0101(02)00162-9

Harrison, N. M. 1984. Predation on jellyfish and their associates by seabirds. Limnology and Oceanography 29:1335-1337. https://doi.org/10.4319/lo.1984.29.6.1335

Hays, G. C., T. K. Doyle, and J. D. Houghton. 2018. A paradigm shift in the trophic importance of jellyfish? Trends in Ecology & Evolution 33:874-884. https://doi.org/10.1016/j.tree.2018.09.001

Headlam, J. L., K. Lyons, J. Kenny, E. S. Lenihan, D. T. Quigley, W. Helps, M. M. Dugon, and T. K. Doyle. 2020. Insights on the origin and drift trajectories of Portuguese man of war (*Physalia physalis*) over the Celtic Sea shelf area. Estuarine, Coastal and Shelf Science 246:107033. https://doi.org/10.1016/j.ecss.2020.107033

Hetherington, E. D., A. Damian-Serrano, S. H. Haddock, C. W. Dunn, and C. A. Choy. 2022. Integrating siphonophores into marine food-web ecology. Limnology and Oceanography Letters 7:81-95. https://doi.org/10.1002/lol2.10235

Labadie, M., B. Aldabe, N. Ong, A. Joncquiert-Latarjet, V. Groult, A. Poulard, M. Coudreuse, L. Cordier, P. Rolland, P. Chanseau, and L. de Haro. 2012. Portuguese man-of-war (*Physalia physalis*) envenomation on the Aquitaine Coast of France: an emerging health risk. Clinical Toxicology 50:567-570. https://doi.org/10.3109/15563650.2012.707657

Lane, C. E. 1960. The Portuguese man-of-war. Scientific American 202(3):158-171. https://doi.org/10.1038/scientificamerican0360-158

Lefebvre, L. 1995. The opening of milk bottles by birds: evidence for accelerating learning rates, but against the wave-of-advance model of cultural transmission. Behavioural Processes 34:43-53. https://doi.org/10.1016/0376-6357(94)00051-H

Lefebvre, L., S. Ducatez, and J.-N. Audet. 2016. Feeding innovations in a nested phylogeny of Neotropical passerines. Philosophical Transactions of the Royal Society B: Biological Sciences 371:2015188. https://doi.org/10.1098/rstb.2015.0188

McInnes, J. C., R. Alderman, M.-A. Lea, B. Raymond, B. E. Deagle, R. A. Phillips, A. Stanworth, D. R. Thompson, P. Catry, H. Weimerskirch, C. G. Suazo, M. Gras, and S. N. Jarman. 2017. High occurrence of jellyfish predation by Black-browed and Campbell Albatross identified by DNA metabarcoding. Molecular Ecology 26:4831-4845. https://doi.org/10.1111/mec.14245

Melville, D. S. 2013. Variable (*Haematopus unicolor*) and pied oystercatchers (*H. finschi*) feeding on lion's mane jellyfish (*Cyanea* sp.). Notornis 60:309-310.

Munro, C., Z. Vue, R. R. Behringer, and C. W. Dunn. 2019. Morphology and development of the Portuguese man of war, *Physalia physalis*. Scientific Reports 9:15522. https://doi.org/10.1038/s41598-019-51842-1

Nascimento, L. S., M. A. Noernberg, T. B. Bleninger, V. Hausen, A. Pozo, L. S. Camargo, C. Hara, and M. Nogueira Júnior. 2022. Social media in service of marine ecology: new observations of the ghost crab *Ocypode quadrata* (Fabricius, 1787) scavenging on Portuguese man-of-war *Physalia physalis* (Linnaeus, 1758). Aquatic Ecology 56:859-864. https://doi.org/10.1007/s10452-022-09947-9

Phillips, N., L. Eagling, C. Harrod, N. Reid, V. Cappanera, and J. Houghton. 2017. Quacks snack on smacks: Mallard Ducks (*Anas platyrhynchos*) observed feeding on hydrozoans (*Velella velella*). Plankton and Benthos Research 12:143-144. https://doi.org/10.3800/pbr.12.143

Phillips, P. J., W. D. Burke, and E. J. Keener. 1969. Observations on the trophic significance of jellyfishes in Mississippi Sound with quantitative data on the associative behavior of small fishes with medusae. Transactions of the American Fisheries Society 98:703-712. https://doi.org/10.1577/1548-8659(1969)98[703:OOTTSO]2.0.CO;2

Pistorius, P. A., D. B. Green, P. J. Seddon, and A. Thiebault. 2020. In situ observation of a record-sized squid prey consumed by a gentoo penguin. Polar Biology 43(3):279-283. https://doi.org/10.1007/s00300-020-02630-5

Pitman, R. L., and L. T. Ballance. 1990. Daytime feeding by Leach's Storm-Petrel on a midwater fish in the eastern tropical Pacific. Condor 92:524-527. https://doi.org/10.2307/1368253

Pollet, I. L., D. Shutler, J. W. Chardine, and J. P. Ryder. 2020. Ring-billed Gull (*Larus delawarensis*), version 1.0. In A Poole, editor. Birds of the world. Cornell Lab of Ornithology, Ithaca, New York, USA. https://doi.org/10.2173/bow.ribgul.01

Stein, M. R., J. V. Marraccini, N. E. Rothschild, and J. W. Burnett. 1989. Fatal Portuguese man-o'-war (*Physalia physalis*) envenomation. Annals of Emergency Medicine 18:312-315. https://doi.org/10.1016/S0196-0644(89)80421-4

Thiebot, J.-B., K. Ito, T. Raclot, T. Poupart, A. Kato, Y. Ropert-Coudert, and A. Takahashi. 2016. On the significance of Antarctic jellyfish as food for Adélie penguins, as revealed by video loggers. Marine Biology 163:108. https://doi.org/10.1007/s00227-016-2890-2

Thiebot, J.-B., and J. C. McInnes. 2020. Why do marine endotherms eat gelatinous prey? ICES Journal of Marine Science 77:58-71. https://doi.org/10.1093/icesjms/fsz208

Valenti, D. 2016. Due Cornacchie grigie *Corvus cornix* si alimentano con meduse. Alula 23:157.