



## Assessing Avian Predators of Japanese Murrelets on Birojima

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### Abstract

Every year large numbers of Japanese Murrelet (*Synthliboramphus wumizusume*) carcasses and depredated eggs are found on Birojima. The depredated eggs lack the serrated edges characteristic of rodent predation and the carcasses have bare, intact breast bones typical of the work of an avian predator. The purpose of this project was to determine the type of avian predators that prey on Japanese Murrelets on Birojima and to assess the extent to which this predation occurs. We implemented several techniques to answer these questions. We set out cameras at 11 sites for varying amounts of time between early January, 2016 and mid-July in areas where Japanese murrelets are known to nest. In addition to the camera work, we carried out surveys of potential avian predators from the lighthouse on Birojima on 20 April and 17 July in 2016 and made observations of crows commuting to the island from a vantage point on Mt. Tomi, north of Kadogawa and a few other places in the vicinity. Furthermore, we surveyed the island for avian predator nests and counted depredated eggs and carcasses in seasons of 2016 and 2017. We also reviewed monitoring projects done by the Biodiversity Center of Japan (BIODIC), which started in 2004, other project done by Japanese Murrelet Population Survey Team (JMPST) of the Japan Seabird Group (JSG), and personal information. The cameras took over 13,000 photos of 15 identifiable species of birds. Several photographs were taken of Large-billed Crows (*Corvus macrorhynchos*) and Carrion Crows (*C. corone*) preying on Japanese Murrelets and one photo of a Large-billed Crow with an egg in its beak. We found many Black Kites (*Milvus migrans*) and Large-billed Crows during the lighthouse surveys and fewer Carrion crows. We confirmed that there were regularly 2 active crow nests on the island and a possible third nest. At the one of active nests, there were about 30 or more carcasses in the vicinity. We estimated 60 -150 murrelets are depredated by 2-3 pairs of crows every year. Relatively high numbers of murrelets seem to be killed by relatively small numbers of crows at Birojima. We did not see crows travelling to the island during our mainland surveys. It is likely that a few individuals of crow have become specialists on Japanese Murrelets. Both cameras and on island surveys for avian predators proved to be effective techniques to assess predator identity and pressure.

**Key words:** Japanese Murrelets, Large-billed Crow, Carrion Crow, predation, camera, Birojima

### Introduction:

Every year large numbers of Japanese Murrelet (*Synthliboramphus wumizusume*) carcasses and depredated eggs are found on Birojima, near Kadogawa, Kyushu. We suspected that avian predators were responsible for the predation because the depredated eggs lacked the serrated edges characteristic of rodent predation and the carcasses had bare, intact breast bones typical of the work of an avian predator. In addition, high levels of Large-billed Crow (*Corvus macrorhynchos*) predation has been documented at Birojima, (Ono et al. 1994). The purpose of this project was to both determine the types of avian predators that prey on Japanese Murrelets on Birojima and to assess the extent to which this predation occurs. We implemented several techniques to answer these questions. We deployed motion sensitive cameras to determine the identity of the avian predators. We carried out island surveys for nests of avian predators. We made counts of potential avian predators from the lighthouse on Birojima as well as counts from the mainland at sites close to Birojima. The purpose of the mainland observations was to see if crows or other avian predators could be seen commuting to Birojima from mainland roost sites. Lastly, we counted carcasses and carried out nest monitoring of murrelets.



**Methods:**

**1. Camera Traps**

We used Bushnell motion sensing cameras for this study. We set out 11 cameras at 8 sites in 2016 (Figure 1). The camera sites were placed in areas where Japanese Murrelets are known to nest or in places where carcasses, depredated eggs or feather piles were observed or near suspected crow nests (Figure 2). The cameras ran from early January to mid-July 2016.



Fig. 1. Yutaka Nakamura setting up a motion sensing camera in Japanese Murrelet colony on Birojima. Photo: N. Karnovsky

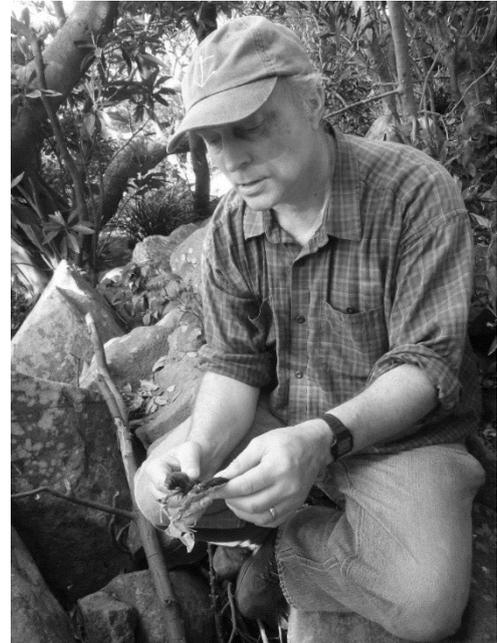


Fig. 2. Harry Carter examining Japanese Murrelet carcass. Photo: N. Karnovsky

**2. Visual Surveys for Avian Predators**



Fig. 3. Harry Carter, Kuniko Otsuki, and a member of the Coast Guard survey for avian predators from the lighthouse on Birojima. Photo: N. Karnovsky.



### Lighthouse

In 2016, counts of crows were conducted at the lighthouse on Birojima (20 April and 17 July) (Figure 3). The lighthouse is located at the highest elevation of Birojima (75 m) and is about 11 m high. The roof of the lighthouse is slightly above the tops of most trees in this area. A door allows access to the roof of the lighthouse where an observer can view the top of the tree canopy, some coastal areas, and waters around most of the island. We counted birds seen or heard every 5 minutes. We used binoculars (Vortex Viper 10x42; Nikon 8x32) during these surveys.

### Mainland:

Surveys for crows commuting to Birojima from the mainland were carried out at Mt. Tomi, north of Kadogawa on the 22nd April. Mt. Tomi is located about 3.5 km NW of Birojima. Surveys were carried out from the picnic table in the parking lot at dawn (05:20-06:40) and dusk (17:05-18:25). We found that it was possible to observe birds in the Mt. Tomi area (including forested areas below the parking lot and the parking lot area), and on Birojima, Nakabae Rock, and breakwaters off the entrance to Kadogawa Harbor from this vantage point. We also carried out supplementary surveys at Umagase (21 April), Yasuiga Hama Beach (22 April) and other locations. Counts were conducted over a period of about 60-80 minutes and included scans every 5 minutes of all visible areas from the vantage point with a spotting scope (Kowa 30X).

### Nest Surveys

In addition, we searched the island for crow nests on 20 April, 23 April and 16-17 July and compared our results to those of the Biodiversity Center, Nature Conservation Bureau, Ministry of the Environment (BIODIC) in 2011 (BIODIC 2012) and 2014 (BIODIC 2015).

### Nest monitoring and Carcass Counts

We counted murrelet carcasses on 20 April, 23 April and 16-17 July, 2016. We compared those data to those collected in 2011-2014. In 2016, we monitored 33 nests of Japanese Murrelets on the north side of Birojima to measure hatching success and predation. We compared those data to 2013. In 2013, 27 nests were tagged in plots under the forest canopy in the same general area (Whitworth et al. 2014). Four of those nest sites were monitored again in 2016.



Fig. 4. A Carrion Crow with a murrelet it has killed.



## Results

### 1. Camera Traps

The cameras took over 13,000 photos. Many of these photos had been triggered by waving vegetation, however photos of 15 identifiable species of birds were taken. In March, two photos were taken of a Large-billed Crow with something white and fluffy in its bill which we suspected was a murrelet. Then in April, a Carrion Crow was photographed killing a murrelet (Figure 4) and a Large-billed Crow was photographed either stashing or retrieving a murrelet. There was one photograph of a Large-billed Crow with a murrelet egg in its beak in April.

### 2. Visual Surveys for Avian Predators

#### Lighthouse

On 20 April, we surveyed from the top of the lighthouse from 13:20 to 14:24. The most common birds observed were Black Kites and Large-billed Crows. One to four Large-billed Crows were observed per scan; a few appeared to perch in trees near the SE end of the island (Table 1). A pair of Peregrine Falcons (*Falco peregrinus*) appeared to be breeding at Birojima and were observed landing on the cliff on the SE side of the island. Osprey (*Pandion haliaetus*) and Black-tailed Gull (*Larus crassirostris*) also were noted. At least 9 surf fishermen were noted around Birojima from the *Tomoyuki Maru* as it passed around the island. During the count from the lighthouse, we did not observe Carrion Crows but we observed 2 Carrion Crows flying above the canopy after the survey at 15:40. On 17 July, we counted potential avian predators from 12:10 to 13:45. The survey was stopped between 12:55 and 13:18 because of heavy rain. Only Large-billed Crows were recorded during the counts, with 1-5 per scan. For further details on these surveys see Otsuki et al (2016).

#### Mainland Surveys

During the mainland surveys for avian predators we found crows in the Mt. Tomi area, and 1 or 2 were seen at Birojima, Nakabae Rock and the breakwaters. Six crows flew SW from the Mt. Tomi area toward Kadogawa, and 2 crows flew east into the Mt. Tomi area from the direction of Kadogawa. Mt. Tomi appears to be a roosting location but we could not determine how many birds might roost there (Otsuki et al. 2016).

#### Nest Searches for Avian Predators

In 2016 and 2017 we confirmed that there were two Large-billed Crow nests on the island and a possible third nest (Figure 5). In 2016, the two nests were about 100 m apart. The nest number 1 mentioned was active and attended by two adult Large-billed Crows on 23 April, 2016 (Figure 5). Through the entire breeding season in 2016, within 30 m from this nest, 31 murrelet carcasses, 4 murrelet feather piles, 4 murrelet eggshell fragments (including a depredated egg), and one leg of a Wood Pigeon (*Columba janthin*) were found. No murrelet carcasses were found below the second nest or anywhere else on the SW part of the island; only one carcass

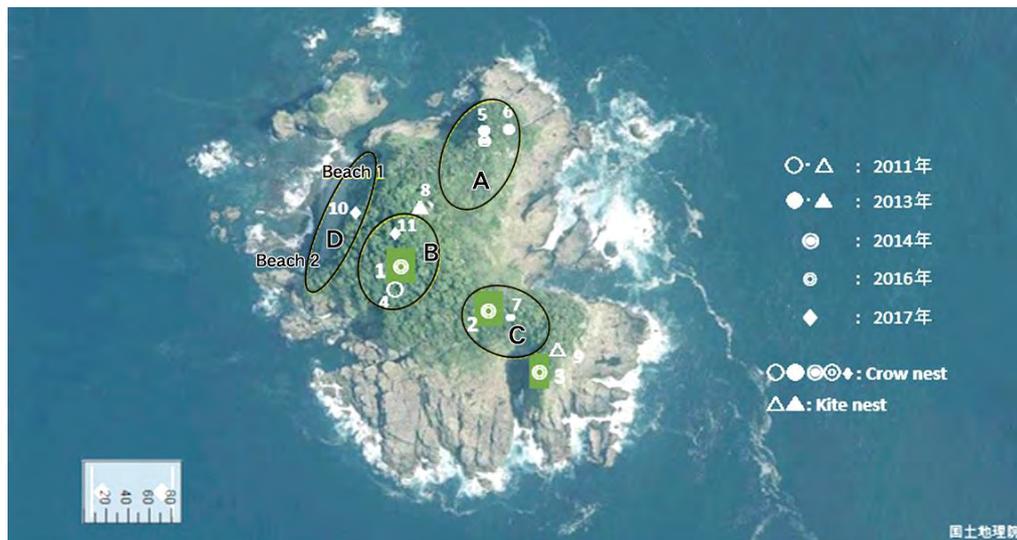


Fig. 5. Locations of crow nests on Birojima in 2011, 2013, 2014, 2016- 2017 (including Black Kite nests).



was found between the nests. It is possible this second nest was not active. In 2016, 41 murrelet carcasses were found on the beach (the area D). It appears that Carrion Crows catch the murrelets in the colony and then consume them on the beach (Otsuki et al. 2016).

In 2017, 26 murrelet carcasses were found in the area B where 31 carcasses were found in 2016. There were two Large-billed Crow nests in the area B, and it was possible one of two was active. In the area D, 30 murrelet carcasses including 2 chicks were found in 2017. One crow nest (number10) was found in this area (N. Nakamura, unpublished data)). This nest was suspected to be a Carrion Crow nest.

### 3. Nest Monitoring

In 2016, in 18 of the 33 nests monitored, at least one egg hatched. In 2 nests, eggs failed to hatch. In 13 nests, eggs were missing; no eggshells were found inside or outside of the nest site. We assumed that these eggs had been removed by crows. Hatching success was lower in 2016 (55%; n = 33) than in 2013 (77%; n=26) (Otsuki et al. unpublished). Similar low hatching success (55%) also had been found in 1993 when high predation also was recorded (Ono et al. 1994).

### Conclusions

The multi-pronged approach we took to understand sources and rates of predation of murrelets provided several new insights. The camera traps revealed that both Large-billed Crows and Carrion Crows prey on murrelets. Nest searches for those predators confirmed that some of the Large-billed Crows were nesting on the island. Likewise surveys from the lighthouse were effective in providing a sense of the high level of crow activity on the island. We did not find our mainland surveys to be very useful however they did provide some information on crow activity in the region. Assessing nest fates showed that high numbers of eggs are taken by avian predators. Overall, avian predation of Japanese Murrelets is a significant source of mortality. Otsuki et al. (2016) estimate that each resident Large-billed Crow pairs take 60 – 150 murrelets per year. We found that Carrion Crows are also responsible for high levels of predation. There were many carcasses near the suspected Carrion Crow nest. Crows likely brought murrelets around their nests to consume or Carrion Crows roost on the mainland or nearby rocks and commute to the island to forage on murrelets. It appears that there are a few crows that have learned to specialize on murrelets however this should be studied further.

### Directions for future research

In the future, the Japanese Murrelets would benefit from further study of avian predators to determine how widespread the behavior of eating murrelets is amongst crows in the area. In carrying out this study we noticed that crows often attend sites where fishermen have discarded bait. Keeping bait inaccessible may deter crows from discovering the island. Crow populations have likely increased in the Kadogawa region as they are known to thrive in areas where they can access food in trash cans. Increasing the number of covered trash bins could help to reduce the number of crows in the region.

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### Literature Cited

- Biodiversity Center, Nature Conservation Bureau, Ministry of the Environment (BIODIC). 2012. Monitoring site 1000 seabird project report in Heishi 23. (Online)  
[https://www.biodic.go.jp/moni1000/findings/reports/pdf/h23\\_seabirds.pdf](https://www.biodic.go.jp/moni1000/findings/reports/pdf/h23_seabirds.pdf). Accessed on 21 October 2016.
- Biodiversity Center, Nature Conservation Bureau, Ministry of the Environment (BIODIC). 2015. Monitoring site 1000 seabird project report in Heisei 26. (Online)  
[https://www.biodic.go.jp/moni1000/findings/reports/pdf/h26\\_seabirds.pdf](https://www.biodic.go.jp/moni1000/findings/reports/pdf/h26_seabirds.pdf). Accessed on 21 October.
- Ono, K., J.N. Fries & Y. Nakamura. 1994. Crow predation of Japanese Murrelets. *Urban Birds* 11: 63-68.
- Otsuki, K., H. R. Carter & Y. Nakamura. 2016. Patterns of occurrence of crows at Birojima and Kadogawa, Kyushu, Japan, in 2016. Unpublished report, Marine Bird Restoration Group, Fukushima-shi, Fukushima-ken, Japan. 26 p.



- Otsuki, K., H. Carter & Y. Nakamura. In press. Preliminary studies of crows, the main predators of Japanese Murrelets, at Birojima, Miyazaki-ken. Annual Report of Pro Natura Fund Vol. 26. Pro Natura Fund. Tokyo, Japan [In Japanese]
- Whitworth, D., H. Carter, Y. Nakamura, K. Otsuki & M. Takeishi. 2014. Hatching success, timing of breeding, and predation of Japanese Murrelets (*Synthliboramphus wumizusume*) at Birojima, Miyazaki-ken, Japan, in 2013. Unpubl. report, Japan Seabird Group, Hokkaido University, Hakodate, Hokkaido, Japan. 54 p.

#### 摘要

枇榔島では、毎年多くのカンムリウミスズメ(*Synthliboramphus wumizusume*)の死体と捕食された卵が確認されている。腐敗した卵は、げっ歯類の捕食に特徴的な鋸歯状の縁を欠いており、死体は、鳥類による捕食者でみられる典型的なむき出しで無傷の胸骨を有していた。このプロジェクトの目的は、枇榔島におけるカンムリウミスズメの捕食者を特定し、その捕食の程度を評価することであった。私たちは、これらの問いに答えるため、いくつかの手法を試みた。私たちは、モーション探知カメラを用いた調査を実施した。2016年1月初旬から7月中旬にかけて、カンムリウミスズメの営巣が知られている11カ所に、さまざまな時間の間隔でカメラを設置した。カメラワークに加えて、2016年4月20日と7月17日に枇榔島の灯台から想定される鳥捕食者の調査を行った。また、門川北部の遠見山と他数カ所において、島通いをするカラス確認のための調査を実施した。さらに、2016年と2017年のシーズンには、捕食する側の鳥類の営巣調査を実施、あわせて捕食された卵および死体の数も確認した。また、生物多様性センター(BIODIC)により2004年に開始されたモニタリングと、日本海鳥グループ(JSG)のカンムリウミスズメ個体数調査チーム(JMPST)によって実施されたプロジェクト、その他の個人的な情報の検証も行った。カメラは、13,000枚の写真を撮影し、15種の鳥類が特定された。そのうちの何枚かが、カンムリウミスズメを捕獲しているハシブトガラス(*Corvus macrorhynchos*)とハシボソガラス(*C. corone*)をとらえており、その中には、嘴にカンムリウミスズメの卵をくわえたハシブトガラスの写真も含まれていた。灯台からの調査では、多くのトビ(*Milvus migrans*)とハシブトガラス、そして少数のハシボソガラスが確認された。島には、毎年2つのカラス類の巣が存在しているようで、3番目の巣の可能性も示唆された。繁殖が進行していた1つの巣の周辺には、約30以上のカンムリウミスズメの死体が確認された。我々は、毎年2~3組のカラスにより、60~150羽カンムリウミスズメが捕食されたと推定した。枇榔島では、比較的少数のカラスによって比較的多くの数のカンムリウミスズメが殺されているようである。私たちは本土からの調査中に、島に通っているカラス類は確認しなかった。数羽のカラス類がカンムリウミスズメについて専門家のように熟知している可能性が高い。捕食者の特定と捕食圧の評価のためには、カメラでの調査と島での現地調査の双方が効果的であることが証明された。

キーワード：カンムリウミスズメ、ハシブトガラス、ハシボソガラス、捕食、カメラ、枇榔島