

there is disapproval of killing dugongs among many people, especially women (Marsh *et al.* 1995). All of the hunters indicated that they preferred the meat of females and juveniles rather than that of adult males. If females and immature animals are preferentially taken, future recruitment will be reduced more significantly than if hunting targets males or takes animals at random.

Although the main motive for hunting dugongs is for their meat, these animals are also killed for the creation of jewelry items made from the animals' ribs. In the past, atlas vertebrae from dugongs were obtained to make bracelets that were only worn by chiefs (Brownell *et al.* 1981). Although this traditional use has diminished in importance, Marsh *et al.* (1995) found jewelry that was locally crafted from dugong ribs on sale at four stores in Koror. At least two of the retailers knew this activity was illegal (*ibid.*).

Traditionally dugongs were hunted from canoes with heavy spears (Rathbun *et al.* 1988). More recently, dugongs have been hunted mainly at night from small outboard-powered boats (>35hp) with spears, firearms, or dynamite (Brownell *et al.* 1981). Most dugongs are harpooned after being chased (Marsh and Lawler 1998). The dugongs are ambushed from boats as they move with the tide onto or off the shallow seagrass beds where they feed at night (Brownell *et al.* 1988). Residents indicate that dugong movements are predictable and they are relatively easy prey. In 1992, 23 knowledgeable locals (including 5 admitted dugong hunters) were interviewed by Marsh *et al.* (1995). These informants claimed that at least 13 dugongs had been killed in 1990. At least five dugongs were taken between December 1996 and December 1997. Marsh (2002) found that all hunters were aware that killing dugongs was illegal and that the motive for the hunting was that it is an exciting way to obtain meat.

Marsh *et al.* (1995) considered that any deliberate exploitation of dugongs in Palau is unsustainable. Population modeling by Marsh (1986) has suggested that a sustainable level of exploitation of dugongs may be as low as 2 percent of females per year. This means that at least 250 females would be needed to support an annual take of 5 females from Palauan waters. A population of this size is considered to be extremely unlikely given the low number of dugongs sighted during the aerial surveys, suggesting that documented levels of take are not sustainable and will lead to further declines of the species. Marsh (1994) considers that any deliberate exploitation of dugongs in

Palau is unsustainable and the current small population found in Palau is unlikely to be able to sustain the current level of poaching (Marsh and Lawler 1998).

C. Disease or Predation

Dugongs are susceptible to a wide range of diseases. Some of these diseases are infectious or parasitic and include pneumonia, pancreatitis, and dermatitis. Wild dugongs support a range of parasites, including at least 19 species of trematodes and one species of nematode internally, and a barnacle and a copepod externally (Eros *et al.* 2000). Bryden *et al.* (1998) and Smith *et al.* (1978) found that dugongs may also carry a range of other diseases documented in marine mammals such as leptospirosis, lobomycosis, cryptococcosus, blastomycosis, caliciviruses, salmonellosis, morbillivirus, toxoplasmosis, tuberculosis, and hepatitis. Any outbreak of disease could have devastating effects on this isolated population.

While it appears that people have had the most serious and long-term impacts on dugong populations, sharks are probably the main natural enemy of dugongs. It has been reported that dugongs will defend themselves against sharks, however. Lekagul and McNeely (1977) found that individual dugongs will "gang up" on sharks in shallow waters and drive them off by butting them with their heads. Even so, a devastating attack was reported by Anderson and Prince (1985), during which 10 killer whales surrounded and killed approximately 40 dugongs.

D. The Inadequacy of Existing Regulatory Mechanisms

Marsh and Lawler (1998) identified strengthening and enforcing laws to protect dugongs in Palau as the highest conservation priority in "Action Plan for the Management of the Dugong in Palau". Until recently, Palauan legislation relevant to the dugong was found in the chapter entitled Protected Sea Life, subchapter iv, on dugongs. The first section of the law stated that "no person shall kill, trap, capture, wound, possess, transport, restrain or otherwise have under his control any dugong or any part or product." A person found guilty of violating this section for the first time could face a jail term of not more than 6 months, or a fine of not more than \$50.00, or both. For any subsequent offense, the convicted person would be imprisoned for not more than 1 year, or fined not more than \$100.00, or both. If a dugong was accidentally caught in a fishing net or

by any other fishing method and was still alive, it was required to be released immediately. If found dead, and this fact was affirmed by the chief executive officer of the state, the dead dugong would be released to the person who found it. Marsh *et al.* (1995) found that the hunters they interviewed were not willing to stop hunting while others were continuing to do so, especially when the punishment itself was of little consequence.

In 1996 and 1997, the Palau Conservation Society began a Dugong Management and Education Program (Marsh *et al.* 2002). The dugong was used as a target species to raise awareness and establish pride in Palau's natural heritage. This effort was aimed, in part, at raising the understanding of the general public about the status of the dugong in Palau as well as trying to increase public support for tougher laws to protect dugongs. The effort seemed to be effective in changing attitudes. In 1998, although hunting activities continued, it was being conducted secretly, as opposed to occurring more openly as was found in 1991 (Marsh *et al.* 2002).

On October 31, 2002, a new law was passed in Palau to help protect the dugong. It sharply increased penalties and may be more effective in deterring poachers than the previous law. First-time offenders now face a \$5,000 to \$10,000 fine and a jail term of 3 months to 1 year. Each subsequent offense can result in a fine of \$10,000 to \$20,000 and a jail sentence of 6 months to 3 years. The government can seize the dugong or part of the dugong that was taken in violation of the law as well as any assets used in the taking of the dugong, including boats, cars, and nets. The new law also encourages citizens to protect dugongs by lodging complaints against violators. If the case is won, the citizen responsible for the complaint can receive any expenses incurred in the action and a reward of 50 percent of any fine actually collected from the violator. In addition, the new law calls for the establishment of educational programs for Palauan citizens and the general public about the dugong. Finally, there is a section that requires the completion of Environmental Impact Statements before any new development occurring in dugong habitat. This would allow the Ministry of Resources and Development or the Environmental Quality Protection Board to deny any construction permits or require appropriate mitigation if dugong habitats are adversely affected.

As discussed, the Republic of Palau has significantly strengthened its legislation banning dugong hunting.