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An Action Plan for Protecting Okinawa's Dugong

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Introduction

H. Marsh, H. Penrose, C. Eros and J. Hugues (2002) have summarized the habitat conditions and measures needed for the protection of the Dugong (*Dugong dugon*), which is in a declining trend in various areas throughout the world. They also recommend that immediate measures be taken to protect Dugong in areas where they are in danger. Their report was published by the United Nations Environment Program (UNEP) Department of Early Warning and Assessment.

In Japan, year-round habitat for Dugong is limited to the east coast of northern central Okinawa Island. Thus, their distribution area is small and isolated from other populations, and their numbers are very low (Kasuya et al, 1998, 1999). At the center of their habitat area, offshore of Henoko village in Nago City township, there is a plan to landfill coral reef for construction of a joint United States military / public civilian airport. Incidental bycatch from entanglement in fishing nets also occurs in their habitat area, and stranded carcasses thought to be victims of entanglement have also been found. The possibility that Okinawa's Dugong will go extinct is therefore exceedingly high..

This report outlines the problems threatening the survival of Okinawa's Dugong, and presents an Action Plan of measures that must be adopted to avoid these threats.

Threats to Dugong Survival

1. Construction of the Military/Civilian Airport

Observation records indicate that the year-round habitat for Dugong in Okinawa lies in the marine area between Ada in Kunigami village and Kin Bay, a distance of about 70 kilometers as the crow flies. Henoko village in Nago City township, chosen as the site for construction of a facility to serve as an alternative to Futenuma Air Base, is located approximately at the center of this year-round habitat area. The marine area that includes Henoko and stretches from offshore Kayou in Nago City township to Matsuda in Ginoza village is where the highest incidence of Dugong sightings has occurred (see Fig. 1).

The planned military/civilian airport will be 2500 meters long and 730 meters wide, and the shortest distance between the airport and the shoreline at Henoko will be approximately 1000 meters (see Fig. 2). The plan calls for landfill of the site's coral reef for airport construction. If this plan is carried out, a Dugong resting site (outside the reef) and a feeding site (seagrass beds in the reef lagoon), as well as the corridor between these two (a gap in the reef) in the Henoko area will be largely destroyed. Destruction of the seagrass beds closest to the shoreline will be particularly extensive, with the level of destruction lessening towards the reef. However, the zone of lesser destruction near the reef includes an area of the Dugong's preferred food, *Halophila ovalis*, that is an important feeding site. Also, even if the seagrass beds are not directly landfilled, they may degenerate due to precipitation of red-silt sediment during airport construction and changes in ocean currents after its completion. The landfill will take place in a section of coral reef where there is a large expanse of the area's shallowest water. This landfill will have a significant, negative impact on the live coral seaward of the site, and may cause the whole reef to degenerate.

When the airport comes into use, the various types of military exercises to be carried out there, as well as the takeoff and landing of civilian aircraft, will cause habitat disturbance and negative impacts to a significant expanse of Dugong habitat, and may render impossible their survival at the site.

2. Death from Incidental Bycatch

When a Dugong is killed in a set net or gill net or is stranded, these events are usually reported in the media and the dead animals taken to an aquarium, so most cases of incidental bycatch leave some kind of record. Relatively clear-cut records of incidental bycatch since 1979 have been complied into Table 1, based on information from the Dugong Network Okinawa (2001). It is thought highly probable that stranded carcasses were also animals killed in nets. As shown in the table, during the 23 years from January 1979 to August 2002, there were 10 cases of incidental bycatch and 7 carcasses stranded for a total of 17 records. In terms of timing, there were 4 cases in the 1980s, 9 cases in the 1990s, and 3 cases during 2000 alone. Because the Okinawan Dugong population is exceedingly small – estimated to be fewer than 50 (Mammalogical Society of Japan, 1997) – incidental bycatch is a major threat to its survival. Table 2 summarizes the situation of set nets in the marine areas of towns and villages in the Dugong habitat area. Large-scale set nets are rare, and even medium-sized set nets are not very common, the prevalence of gill nets being characteristic of the area. Geographically, most Dugong incidental bycatch takes place in the area between Ginoza village and Kin Bay.

3. Loss of Seagrass Beds

According to the Environment Agency of Japan (1997), based on surveys carried out in 1989 the total area of seagrass beds on Okinawa Island (including its small offshore islands) was calculated at 1,282 hectares (ha.). Relatively extensive beds included Henoko (173 ha.), Awase (112 ha.), Oominezaki (64 ha.), Yabuchijima (60 ha.), Miyagijima (59 ha.), Yakadahama (59 ha.), among others.

With respect to areas where there are records of Dugong, Table 3 lists the sizes of seagrass beds for each town or village, both in the year-round habitat area north of Kin Bay on the east coast, and in the temporary habitat area north of Nago City on the west coast. [NB: Nago City proper is on the west coast of Okinawa Is., but Nago City township extends to the east coast, where Henoko is located.] There were 539 ha. of seagrass beds in the year-round habitat area and 89 ha. of seagrass beds in the temporary habitat area. However, these figures date from 1989, and the present situation is unclear. There is an urgent need for new surveys to enable comparisons with the 1989 data. Present sources of impacts on sea grass beds include red silt runoff from erosion on land, inflows of chemical fertilizer and herbicides, edible *mozuku* seaweed aquaculture, landfill for construction of harbor facilities, offshore concrete barrier construction (tetrapods), etc. However, there are no references that contain relevant information about areas presently being impacted, or quantitative or qualitative data about specific effects of these activities on seagrass beds.

4. Pollution from Red Silt Runoff

Okinawa's return to Japanese jurisdiction in 1972 initiated a rush of large-scale civil engineering projects such as dam and road construction, logging, and agricultural development. After this, red silt runoff appeared in rivers all over the island, and the result has been a continuing decline in the health of coral reefs. According to Mitsumoto et al (1995), the presence of red silt runoff/ sedimentation was confirmed in 193 (87%) of the 222 rivers in northern Okinawa Is., traced to the following sources: agricultural fields (50%), land reshaping projects (13%), business sites (11%), civil engineering projects (10%), roads, etc. (10%), US military training grounds (5%). Nakasone et al (1998) found that red silt runoff from US military training grounds originated not only from artillery practice ranges, but also that the used artillery shell disposal site, denuded of vegetation, and the roads and banks along the sides of the roads also functioned as significant sources of red silt runoff. Whenever strong subtropical rains fall, red silt runs off into the rivers, and red silt particles carried down to the sea precipitate, causing degradation of seagrass and coral reef environments.

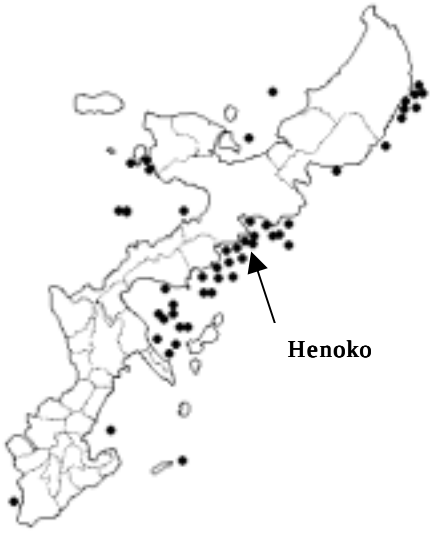

Fig.1. Distribution of Dugong records around Okinawa Is. from 1989 to 2002. Data compiled from Dugong Network Okinawa (2000), the Defense Agency (2000), and the Ministry of Environment of Japan(2003).

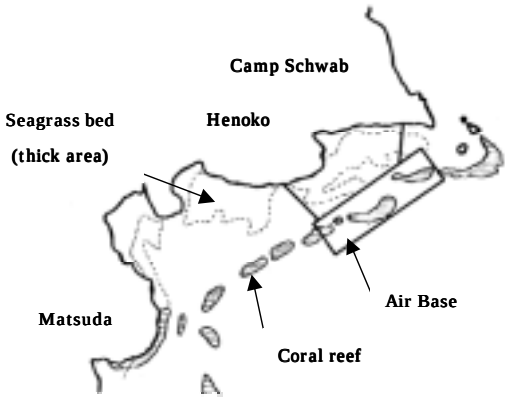

Fig.2. Location of planned Air Base of 2500m length and 730m width on Henoko offshore（Defense Agency of Japan 2002）. Henoko Seagrass Bed is 173 ha. in area and largest one in Okinawa Is（Environmental Agency of Japan 1997）.

Table 1. Records of Dugong bycatch and strandings around Okinawa Is, 1979-2000 (Dugong Network Okinawa, 2001).

Year	Mon.	Day	No.	F/M	Site	Note	dead/alive
1979	1	18	1	F	Kayou, Nago-shi	gill net	alive
1982	3	27	1	M	Kanna, Ginoza-son	stranding	dead
1984	4	24	1	M	Kin-bay, Gushikawa-shi	stranding	dead
1987	1	4	1	F	Fusozaki, Sashiki-cho	stranding	dead
1987	1	14	1	M	Kochiya, Ginoza-son	stranding	dead
1990	5	16	1	M	Kayou, Nago-shi	gill net	dead
1992	5	9	1	F	Kin-bay	set net	alive
1992	5	9	1	M	Kin-bay	set net	dead
1993	12	4	1	M	Kin-bay	set net	alive
1995	12	28	1	F	Abu, Nago-shi	set net	dead
1996	1	15	1	M	Kourijima, Nakijin-son	set net	dead
1997	1	22	1	M	Ginoza-son	set net	alive
1998	11	13	1	M	Kin-bay	gill net	dead
1999	4	1	1	M	Miyagi, Higashi-son	stranding	dead
2000	4	5	1	M	Ginoza, Ginoza-son	stranding	dead
2000	8	27	1	F	Sesoko, Motobu-cho	stranding	dead
2000	11	13	1	F	Kanna, Ginoza-son	set net	dead
Total			17				

Table 2. Numbers of set nets and gill nets in year-round Dugong habitat (Fisheries of Okinawa, 2000).

city, town, village	large set net			small set net			gill net			No. of dead Dugong
	No. of operation	catch(t)	sum(yen)	No. of operation	catch(t)	sum(yen)	No. of operation	catch(t)	sum(yen)	
Kunigami	−	−	−	−	−	−	7	12	11,000,000	
Oogimi	−	−	−	−	−	−	3	14	15,000,000	
Higashi	−	−	−	−	−	−	7	7	7,000,000	1
Nakijin	−	−	−	x	71	63,000,000	10	147	151,000,000	1
Motobu	−	−	−	x	23	17,000,000	x	23	20,000,000	1
Ie	x	−	−	x	17	10,000,000	4	41	37,000,000	
Nago	−	−	−	7	30	27,000,000	26	70	64,000,000	3
Ginoza	x	38	25,000,000	x	−	−	5	6	6,000,000	5
Kin	−	9	8,000,000	6	−	−	−	2	1,000,000	
Ishikawa	3	15	9,000,000	−	−	−	17	36	31,000,000	5
Gushikawa	−	−	−	x	4	3,000,000	−	−	−	(Kin-bay)
Yonashiro	−	−	−	5	16	13,000,000	27	69	63,000,000	
Katsuren	x	−	−	15	32	26,000,000	x	32	30,000,000	
Total	3	62	42,000,000	33	193	159,000,000	106	459	436,000,000	16

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Table 3: Area of seagrass beds around Okinawa Is. (Environment Agency, 1997, based on 1989 data)

1. East coast (year-round habitat)

City,town,village	Site	Area(ha)
Kunigami	Ibunohama	7
Nago	Kayou	8
	Kayou-minami	6
	Abuzaki	2
	Sedake-minami	14
	Henoko	173
	Matsuda-yuhara	4
Ginoza	Matsuda	5
	Ginoza	11
	Kanna-beach	26
Kin	Kinmisaki-kita	33
Yonashiro	Ikemi	3
	Miyagijima-minami	59
	Hamahiga-minami	3
	Kaichudoro-minami	15
	kaichudoro-kita	41
	Heanza-nishi	5
	Kaichudoro-minami	57
	Yabuchijima-higasi	60
Katuren	Kannazaki	3
	Aginamiiwa	4
	Total	539

2. West coast (temporary habitat)

City,town,village	Site	Area(ha)
Ie	Funazubaru	7
Motobu	Bise	5
	Arimahara	25
Nakijin	Kunjyar	8
	Shimohara	16
Nago	Saiide	28
	Yaga	22
	Nohena	43
	Gabu	33
	Total	89

5. Other
Aside from the direct causes noted above, we can also point to the lack of any organization dedicated to research, education and conservation, as well as the overall inadequacy of Japan's conservation system and the poor quality of its practical application. Organizations involved so far include the Ocean Expo Park Aquarium, but with respect to Dugong, so far it has limited itself to keeping a record of stranded carcasses. Also, no university on Okinawa has a marine mammal research department. Applicable laws include the Cultural Properties Protection Law, the Marine Product Resources Protection Law and the Endangered Species Law, but these laws simply prohibit hunting the Dugong and do not deal with any other measures for protection of the species. A July 2001 revision to the Wildlife Protection Law finally included Dugong as a species to be protected under this law, but unless actual plans are adopted to protect the Dugong's habitat area, the situation will not significantly improve.

Action Plan for Conservation of Okinawa's Dugong

This Action Plan for the conservation of Okinawa's Dugong has been summarized in three parts – the goal, objectives and actions. "Goals" are what we hope to ultimately achieve, that is, the underlying objective. "Objectives" indicate things that must be done in order to achieve the goals. "Actions" are methods by which objectives can be realized, and further details are given on what will be necessary to realize these objectives.
The main goal of the action plan is to protect the Dugong and the environment that comprises their habitat in Okinawa. In the short-term, this means stopping the decline in the population's numbers and preventing further environmental degradation of Dugong habitat. The mid- to long-term goal is to strive for recovery of their distribution area, of their habitat's environmental quality, and of their population numbers. Objectives that must be met to achieve these goals, and the various actions that must be taken to realize these objectives, are outlined below.

Goals

Protection of Okinawa's Dugong and their habitat

Short-term goals: Prevention of further decline in population numbers and environmental deterioration of habitat
Mid- to Long-term goals: Recovery of distribution area, habitat environmental quality and population numbers.

Objectives and Actions

Objective 1. Prevent further decline in population numbers.
Action 1-1. Prevent incidental bycatch.
Action 1-1-1. Gain the understanding and cooperation of fishers.
Action 1-1-2. Perform a socio-economic assessment of net fisheries.
Action 1-1-3. Regulate net fisheries. Create a compensation system for fishers.
Action 1-1-4. Create a rescue system for cases of entanglement.
Action 1-2. Prevent collisions with boats.
Action 1-2-1. Gain the understanding and cooperation of boat owners and users.
Action 1-2-2. Create rules for boat operation in the habitat area.

Objective 2. Prevent environmental deterioration of the habitat.
(Clarify factors contributing to habitat deterioration and remove these factors.)
Action 2-1. Prevent land-based pollution.
Action 2-1-1. Gain the understanding and cooperation of farmers and construction contractors.
Action 2-1-2. Stop red silt runoff. Keep red silt from entering rivers.
Action 2-1-3. Re-examine and reform agrichemical use in the watershed.

Action 2-1-4. Keep wastewater from livestock operations and household wastewater from directly entering rivers.
Action 2-2. Stop development projects and other acts that produce negative impacts.
Action 2-2-1. Halt construction of the military/civilian airport.
Action 2-2-2. Halt or regulate military training practice.
Action 2-2-3. Re-examine seaweed (*mozuku*) aquaculture sites and practices.
Action 2-3. Implement appropriate environmental impact assessments for development activities.
Action 2-4 Protect Dugong feeding areas (seagrass beds), resting sites (outer rim of the coral reef), and the corridor between them (reef gap).

Objective 3. Set up a protected reserve.
Action 3-1. Clarify through surveys the objectives, extent, regulations and management methods for the protected reserve.
Action 3-2. Identify the appropriate laws/ ordinances based on the requirements of the reserve.
Action 3-3. Gain the understanding and cooperation of local residents.
Action 3-4. Gain the understanding and cooperation of the national, prefectural, and municipal governments.

Objective 4. Create a conservation management system.
Action 4-1. Clarify through surveys population conservation management methods.
Action 4-2. Set up an organization to act as the central implementing agency for conservation management.
Action 4-3. Establish a network linking the central implementing agency with fishers, [farmers, construction contractors,] local residents, NGOs, research institutes, and the local and national governments

Objective 5. Create a body of research.
Action 5-1. Undertake research on factors leading to population decline.
Action 5-2. Undertake surveys to identify factors leading to habitat degradation and measures to counter them.
Action 5-3. Undertake research in the fields of conservation biology and socio-economics aiming at definition of requirements for a protected reserve.
Action 5-4. Study population conservation management.
Action 5-5. Study habitat restoration/ revitalization options.
Action 5-6. Undertake basic biological research.

Objective 6. Undertake education and awareness-raising. Educate local residents and visitors.
Action 6-1. Develop educational materials based on surveys and research.
Action 6-2. Hold observation tours and study meetings using the educational materials, nurture local nature observers.
Action 6-3 Collect information such as sightings, etc., at the local resident level.
Action 6-4. Set up a space (visitor center) for information exchange, exhibitions, etc.

Objective 7. Promote international exchanges.
Action 7-1. Pursue continued and more profound exchanges with overseas conservation organizations and researchers through newsletters, web sites, etc.
Action 7-2. Hold events for promoting exchange, visit Dugong habitats in other countries.

Objective 8. Promote local exchanges.
Action 8-1. Undertake educational activities aimed at local residents.
Action 8-2. Take part in educational activities at local schools.

Objective 9. Promote information release and citizen participation.

Action 9-1. Publish clear information about the Action Plan and ask local residents for opinions.
Action 9-2. Publish clear information about the Action Plan and ask for cooperation from government agencies, fishing cooperatives and agricultural cooperatives.

Summary

Okinawa's population of Dugong is limited to a small area, has a low number of individuals and is isolated from other populations, so it is threatened closely with extinction. Major threats are construction of a joint military/civilian airport in their habitat area and incidental bycatch from entanglement in fishing nets. An Action Plan to promote conservation of Okinawa's Dugong has been drawn up, with the short-term objectives of preventing further reduction in their numbers and environmental degradation of their habitat, and the mid- to long-term objectives of promoting the recovery of their distribution area, habitat environment and population numbers.

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