



Ebiil Conservation Area

Monitoring Report

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Ebiil Channel, in the northern reefs between Ngarchelong and Kayangel, is one of Palau's most important grouper spawning aggregation sites. Ebiil Channel is an important habitat for many species of fish, including **tiau**, **temekai**, **katuu tiau**, **ksau** and **maml**. In 1994, the traditional leaders of Ngarchelong and Kayangel declared a traditional **bul** that closed the channel to all fishing. In February 2000, the Ebiil Conservation Area was established to extend the closure in order to further protect the fish stocks. The establishment of the conservation area closed the area to any entry, boat traffic and fishing for a period of three years. After the end of three years (in early 2003), the state and the people of Ngarchelong will decide whether to keep the area closed to fishing and entry for a longer period of time. Alternatively, the people may decide to open the area to fishing and/or entry. If this happens, they may also begin to develop a management plan with guidelines for the types of uses allowed in the area and other ways to best protect the fish stocks and habitat of Ebiil Channel.

Ebiil Channel is part of a larger reef system north of Babeldaob that supports a large diversity of marine species. The channels between the reefs, seem to be particularly important to groupers and other fish during spawning seasons when they aggregate in large groups. Fishermen have long known how easy it was to catch large numbers of fish during these times. In 1994, in recognition of the importance of the channels to the health of the fish stocks in the northern reef area, the traditional leaders of Ngarchelong and Kayangel declared a **bul** from April 1 to July 31, closing the eight major channels to fishing at this time. Fishing is allowed elsewhere, but not in the channels during these months or in Ebiil at any time. This will allow large numbers of fish to aggregate and spawn, and thus replenish the stocks of fish on the reefs.

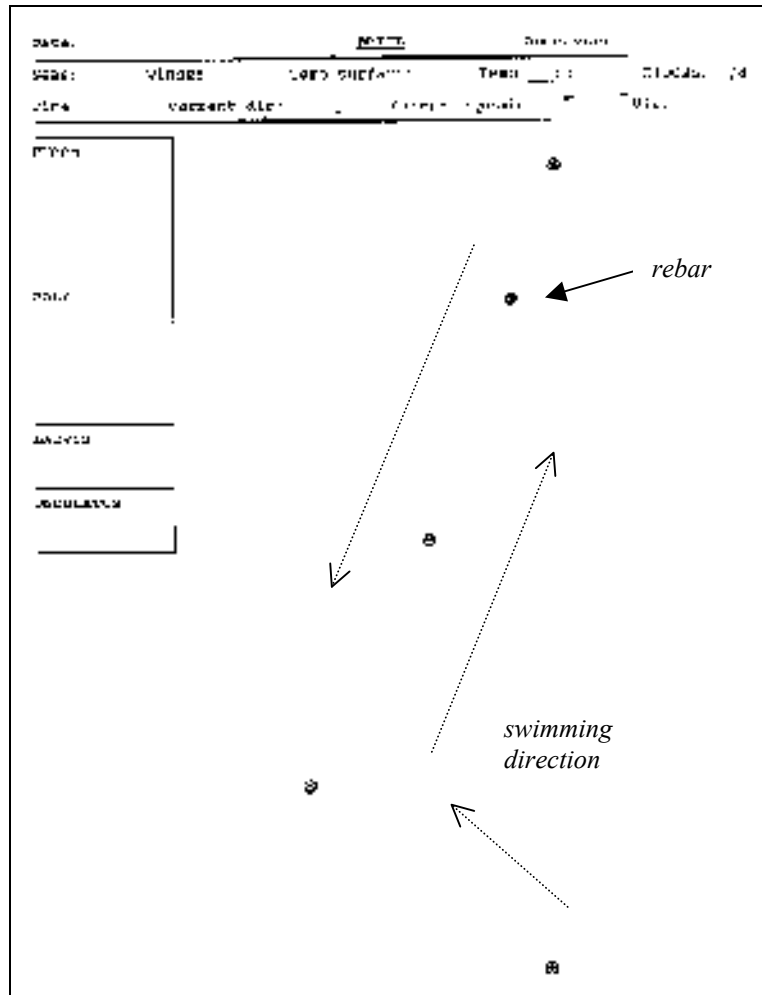
Monitoring program

Over the past year, the Palau Conservation Society and the Palau International Coral Reef Center and have been working with the state of Ngarchelong to monitor the fish stocks in Ebiil Channel. A monitoring program can have many specific goals:

1. gain information about the number of fish and other species that live in the conservation area;
2. watch for changes over time in the health of the conservation area;
3. determine if fish stocks are increasing, decreasing or remaining the same in the conservation area;
4. see if closing the conservation area to fishing can help increase fish stocks outside of the conservation area;
5. see if changes need to be made in the conservation management strategy to best protect fish and other species.

The monitoring program at Ebiil has been collecting data that generally correspond to the first three goals. To date, the researchers have visited the channel four times: September 2000, May 2001, July 2001, and September 2001 in order to observe the spawning aggregations. In May 2001, researchers also conducted coral monitoring transects. To monitor the fish, the researchers chose one site that has been marked on the reef with rebars (see diagram on page 2). The transect is located on the south side of Ebiil near the mouth of the channel. Each time they visit the reef they go to this same place to count the fish present. The researchers use scuba gear to

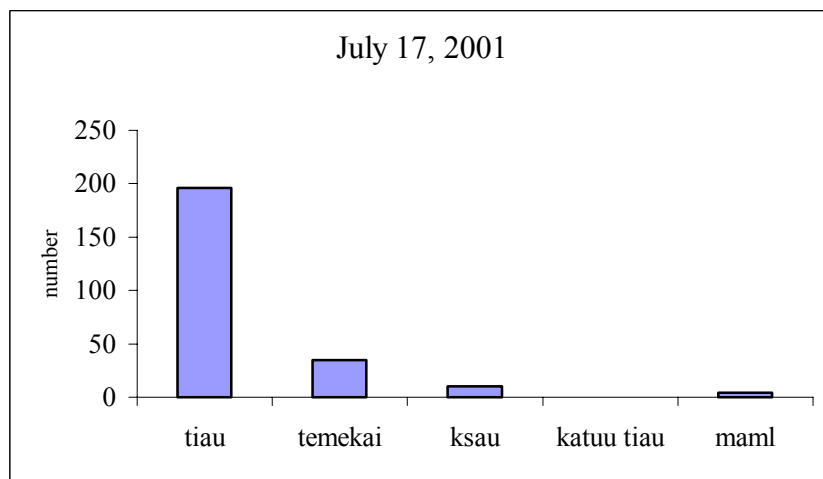
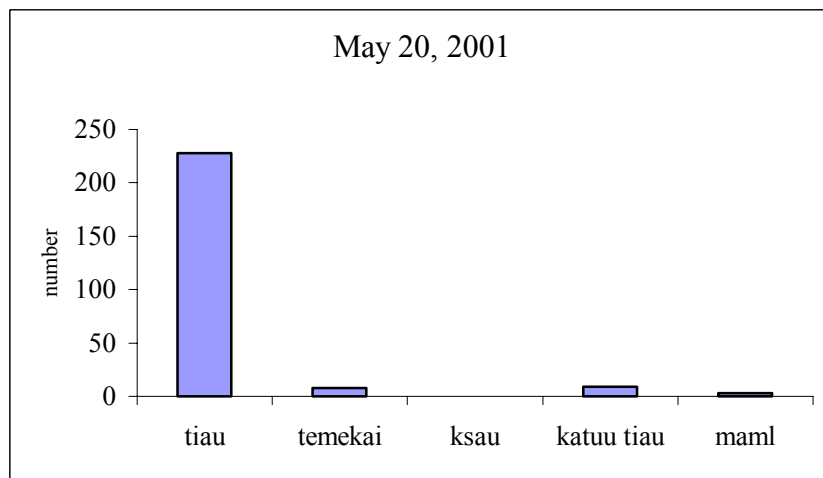
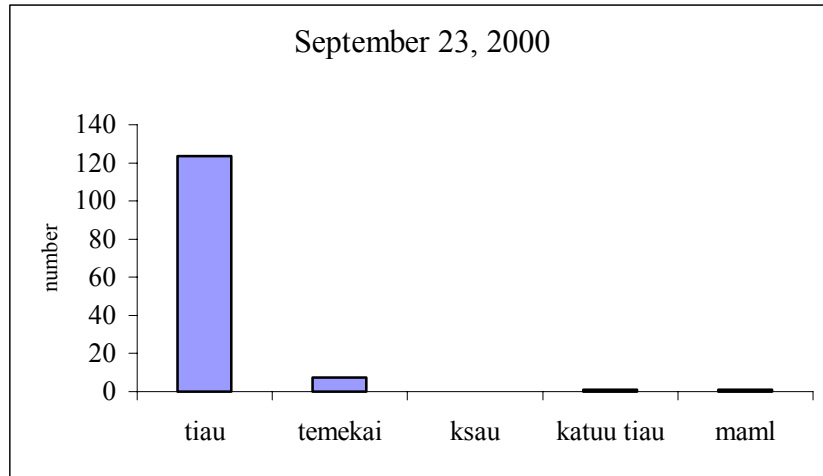
swim around the rebars, recording their observations of five species of fish on underwater paper as they swim around the transect. A copy of the transect site is shown below.

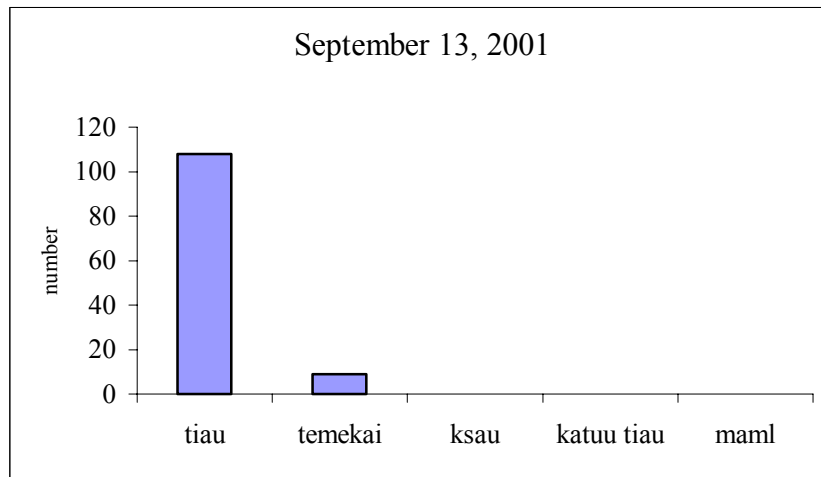


The researchers tried to conduct the transects a few days before the new moon during the months that the species being monitored are known to spawn. Since the number of fish counted was relatively low during the monitoring transects, it appears that the visits did not correspond to peak spawning times.

Many different species use the channel as a spawning area. Other researchers have witnessed **um** (*Naso unicornis*), **kedesau** (*Lutjanus bohar*), **keremlal** (*L. gibbus*) and **kemedukl** (*Bolbometapon muricatus*) form spawning groups at Ngerumekaol, Ebiil and/or Western Entrance (Johannes et al. 1999). However, the monitoring program focused specifically on five species that are important to local fishermen: **tiau**, **temekai**, **ksau**, **katuu tiau** and **maml**. The

results from the monitoring program for these five species are shown in the graphs below. The vertical axis indicates the number of fish counted and the horizontal axis shows the species.





Tiau and **temekai** were the only species that were seen in any significant number during the four monitoring sessions. More than 200 **tiau** were counted in May 2001. The number of **tiau** counted in September 2001 was about 100. The most **temekai** were counted in July 2001 when 35 fish were observed. Very few **temekai** were observed during the other monitoring sessions. Very few **ksau**, **katuu tiau** or **maml** were observed. In fact, **ksau** was only seen in July 2001 when 10 fish were counted; one **katuu tiau** was seen in September 2000 and nine were seen in May 2001. Several **maml** were counted over the course of the monitoring swims: one in September 2000, three in May 2001, four in July 2001 and none in September 2001.

It is important to realize that these figures and graphs represent snapshots of what the researchers saw and recorded while they swam the transect. Environmental factors that affect the variability of fish in an area, as well as water clarity and skill of the researcher could affect the results. If no **maml** were seen during one of these swims, it does not indicate that there are no **maml** in Ebiil Channel. It simply means that the researchers saw none at that time. In addition, this monitoring program cannot detect subtle changes in the fish stocks in a short period of time. There are several reasons for this. Skilled fishermen know that fish are extremely variable - the number and species of fish in an area changes due to tides, moon phase, time of year, time of day and many other factors. Sometimes this variability is predictable, other times it is not. It is difficult for us to compare the monitoring results we have collected so far because of these differences. However, patterns in the variability of fish populations in a region begin to emerge the longer a monitoring program is conducted. Significant changes in fish populations may become obvious over time. Together with data from other scientific studies that have looked at the spawning aggregations in Palau and the observations of local fishermen, we will begin to obtain a more complete picture of the impacts of the conservation area on the health of the fish stocks of the northern reef area.

A preliminary coral cover monitoring program was begun in May 2001 by researchers from the Palau International Coral Reef Center (PICRC). They surveyed the reef slope at 3m and 9m

depth at one place on the southern side of Ebiil Channel. Their results are shown in the table below. The data in the table can be used to compare the results of future coral monitoring activities in the channel.

<i>Depth</i>	<i>Category</i>	<i>Mean % cover</i>
3m	hard coral	9.5
	dead coral	16.9
	algae	15.3
	other (soft coral, sponges, etc.)	3.7
	sand, rubble, silt or rock	24.6
9m	hard coral	11.3
	dead coral	9.4
	algae	31.1
	other (soft coral, sponges, etc.)	3.8
	sand, rubble, silt or rock	24.3

Other relevant research

From 1994 to 1996, Robert Johannes and a team of researchers conducted a study of grouper spawning aggregations in several reef channels around Palau. The goal of their research was to characterize the behavior of the fish in the channels and to document the peak spawning periods for several species of fish at different locations. Their study focused specifically on **tiau** (*Plectropomus areolatus*), **ksau** (*Epinephelus polyphekadion*) and **meteungerel** (*E. fuscoguttatus*). They found that at Ebiil, the peak spawning periods were: 3 to 5 days before the new moon in May through August for **tiau**, 3 to 6 days before the new moon in July for **ksau** and 4 to 6 days before the new moon in June to August for **meteungerel**.

These scientists also attached tags to more than 1000 fish. The tags were of different colors, with basic information about the location and date that the fish was tagged. If fish with tags are caught sometime in the future, the scientists would be able to see where the fish found in different spawning aggregations travel. This would enable them to see if the spawning aggregations are composed of fish from several different reefs. This part of the study provided mixed results because many of the tags were not returned, or if they were, they were cut or covered with so much algae that they could not be read. More than 200 tags were returned to the researchers or to the Division of Marine Resources. They were collected from fish that were caught by the researchers' team or other fishermen. Some were attached to fish that were landed at restaurants or markets in Koror. Some of the tagged fish were caught 5 to 10 km away from the aggregation site where they were originally tagged. Others were observed to return to the same aggregation site each month around the new moon. The researchers say that they had no evidence that the tags affected the fish in any harmful way.

Another relevant research program has just begun by scientists at the Palau International Coral Reef Center (PICRC). PICRC has begun to collect data about coral health for the Republic of

Palau. Several monitoring sites in the northern reef area have been included in this program. The scientists will be carefully monitoring the health of the coral and other invertebrate species. This program is just beginning, and the data collection is not yet complete.

Recommendations for future monitoring programs

As noted above, a monitoring program can have many goals. The initial monitoring program at Ebiil has begun to characterize the state of the resources in the conservation area. However, this program can be improved in order to get more complete and useful information about the impacts of the conservation area to local fish stocks. One of the easiest and most direct ways to monitor the fish stocks is to collaborate with local fishermen. People who fish from these reefs on a regular basis have much more intimate knowledge of the area, the fish that are found, and the state of the environment than outside researchers. Fishermen have already contributed greatly to the design of the conservation area as well as the monitoring program. There are several additional important ways that local fishermen can continue to contribute to the monitoring of the Ebiil Conservation Area:

- record information about fish caught from nearby reefs (species, size, location caught, date);
- observe changes in catch;
- observe activities that occur on land and in the water that may affect the conservation area;
- report tagged fish (report tags to the state office, Palau Conservation Society or the Division of Marine Resources).

The Palau Conservation Society will work with the local communities to design ways that the local fishermen and others can contribute to the research collected about the conservation area. In this way, the conservation area will benefit from the extensive knowledge of local people. An added bonus is that a frequent local presence on the reefs may discourage poachers from fishing in closed areas.

The monitoring program can also be improved by the following changes in the research design:

- more frequent and regular monitoring of spawning aggregations (two or three days in a row during each of the peak spawning months);
- increase number of transect sites to include other parts of Ebiil Channel, other channels or other areas on the reef;
- researchers can work more with local fishermen from Ngarchelong and Kayangel to monitor the conservation area;
- collaborate with other agencies such as the Division of Marine Resources and the Palau International Coral Reef Center to monitor the northern reefs more comprehensively.

The Ebiil Conservation Area, together with the other channels of the northern reef area, are important habitats for many species of marine life, as well as sources of food, income and enjoyment for the residents of Ngarchelong and Kayangel. With continued monitoring and care of the area, we will be able to more fully understand the best ways to protect these habitats for the future.