Preliminary Assessment of Pelagic Fish Caught in the Open Pacific

Public Health Concern and Request of ATSDR:
Residents of the Marianas are concerned about eating pelagic fish caught in the open ocean waters. People have asked if the bombing activities on Farallon de Mendinilla (FDM) could have contaminated the fish that are caught in open waters.

Brief Answer:
Pelagic fish caught in open waters are not likely to contain high levels of explosive residues from FDM and will not pose a public health hazard to people who eat them.

Summary:
ATSDR has examined fish, water, sediment and other media that was collected near bombing ranges and other marine environments where explosive chemicals were dropped or dumped. We also have reviewed numerous files on studies about the accumulation of chemicals in seafood. From this information, **we conclude that pelagic fish caught in open waters are not likely to contain high levels of explosive residues and do not pose a public health hazard to people who eat them.** We cannot draw any conclusions on the pollution that comes from many sources and accumulates in some fish. These contaminants, like metals, pesticides, and polychlorinated biphenyl (PCBs) are found in many areas in the Pacific Ocean and we cannot rule out pockets of higher contamination near the Marianas.

Discussion:
While the bombs and associated weaponry material are destructive to the terrestrial environment and the local habitat, the impact on the food chain beyond the site of the activity is limited. Because unicellular organisms and some shellfish are known to take up and be affected by explosive compounds, ecologists are concerned for local habitats where many bombs are dropped. However, fish and invertebrates are known to take up much less of the explosive compounds than those species, resulting in much less concern for the possibility of people becoming exposed to explosive-residues by eating fish.

FDM appears to have had very few direct marine detonations as the land is used for targeting and reports of surveys indicate that the sea floor is healthy and the fish stock robust (Navy dive reports 2003-2005). Therefore, the majority of chemical migration would occur by erosion of land, which would release explosive chemicals into the ocean water at a much slower rate than from a direct discharge.

The most common explosive chemicals (TNT, RDX, and HMX) rapidly decay in marine environments and do not travel far from where they were deposited. Some aquatic species have been shown to take up these chemicals and their breakdown products, but they are rapidly metabolized and excreted. Picric acid does not break down quickly in

the environment, but even picric acid is quickly metabolized in fish and other invertebrates. Since pelagic fish are caught in open waters or waters far from FDM, we do not expect that there will be sufficient explosive chemicals remaining in the tissue to pose a public health hazard. While this is true for the mobile pelagic fish, we cannot draw a conclusion on fish that remain near a contaminated area for long periods of time. However, because commercial fishing near the island is prohibited (for safety and security reasons), any potentially contaminated fish should not be harvested.

Chemicals such as PCBs, mercury, and arsenic do accumulate in fish. However, there are multiple sources of these chemicals. For this reason, the national and international organizations recommend a seafood monitoring program.

Summary of Supporting Studies:
The following bullets summarize studies that support the above conclusion:

- Pelagic fish are migratory and travel far; thus they eat from many locations, so their exposure to contaminated areas is low [UC Davis 2008];
- Uptake rates and toxicity of explosive compounds appear to be different for unicellular organisms and shellfish than for other species [Nipper and Carr 2005, Rosen and Lotufo 2005, Mukhi et al 2005, Mukhi and Patiño 2008].
- Uptake rates of most explosive chemicals are low in fish and decrease in fish with high oil content [Lotufo et al. 2005, Rosen and Lotufo 2007];
- Pelagic fish have high oil content, as much as 30% [FAO 2008];
- Bioaccumulation of explosive chemicals in fish is low, because fish quickly metabolize and excrete them [Ownby et al. 2005,Yoo et. al 2002, Helene et al. 2003, Lotufo et al. 2005, Lotufo and Lydy 2005, Houston and Lutufo 2005, Blackburn et al. 2004];
- Most explosive chemicals decay rapidly in the water and in the sediment of marine environments [Brannon et al. 2005, Yost et al. 2007];
- Picric acid, which is very stable underwater and in sediments, is metabolized and excreted within a few days [Yost et al. 2007, Nipper et al. 2001, Burton et al. 1983 and 1984, Cooper et al. 1984];
- The fillet tissue samples collected from fish caught in the waters close to the Vieques bombing range and near the Longhorn Army Depot did not contain explosive residues at concentrations that posed a public health hazard. Only trace levels were detected in very few fish in both studies [ATSDR 2000, ATSDR 2003, TCEQ and EPA 2004; USGS 2004];
- International and national organizations propose monitoring programs for fish [WHO 1987, WHO 1999, EPA 2000, EC 2002; FNB 1991];
- FDM and its neighboring waters are restricted (for 3 miles) [Navy 2005];
- FDM surveys indicate very little direct seafloor detonation with all planned bombing to occur on the island [Navy 2007, 2008].

Conclusions:

Pelagic fish caught in open waters will not contain high levels of explosive residues and will not pose a public health hazard to people who eat them.

There are many sources of substances that are known to accumulate in pelagic fish. These sources are usually found near industrial operations. A seafood monitoring plan should protect people from ingesting these industrial chemicals that are known to accumulate.

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