



# Using Life History to Improve Stock Assessments

## Life History of 'Opakapaka

Hawai'i Pink Snapper



(*Pristipomoides filamentosus*)

### HABITAT

Juveniles are found in soft, sandy sediment flats below 100 meters (300 feet) depth where they remain for less than a year before moving to waters below 150 to 190 meters (450 to 570 feet) depth. Larger juveniles are found over rugged volcanic substrate.

Adults are found on the steep slopes and deep-water banks, aggregating near areas of high bottom relief and on the up-current side of atolls. During the day, they inhabit areas over high relief at 100 to 400 meters (300 to 1,200 feet) depth. At night, they migrate into shallower flat, shelf areas at 30 to 80 meters (90 to 270 feet) depth.

### DIET

'Opakapaka feed primarily below 100 meters (300 feet) and stay within several meters to mid-water off the bottom. They forage above 100 meters (300 feet) at night over sediment flats.

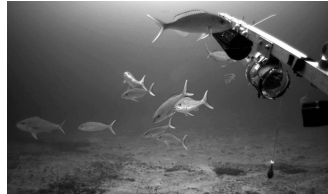
They eat small crustaceans (crabs, shrimps and stomatopods), other juvenile fish, mollusks (octopods, squids and micro gastropods), gelatinous plankton (salps and heteropods) and echinoids (e.g., sea urchins). They have no strong preference for a particular prey type. They show a seasonal and diel variation in diet, feeding on bioluminescent salps at night.

### REPRODUCTION

'Opakapaka are sexually mature at 3.5 years. They spawn over a period of 5 to 7 summer months during all lunar phases and up to 25 times in a single month, releasing more than 3 million fertilized eggs per spawn.

### REFERENCES

- Langseth B et al., 2018. Stock assessment for the main Hawaiian Islands Deep 7 bottomfish complex in 2018 with catch projections through 2022. Honolulu: NOAA Pacific Islands Fisheries Science Center.
- Moffitt R and F Parrish. 1996. Habitat and life history of juvenile Hawaiian pink snapper, *Pristipomoides filamentosus*. Pac Sci 50(4):371-81.
- Kikkawa B. 1984. Maturation, spawning, and fecundity of opakapaka, *Pristipomoides filamentosus*, in the Northwestern Hawaiian Islands. In: Grigg R and KY Tanoue (eds.). Proceedings of the Second Symposium on Resource Investigations in the Northwestern Hawaiian Islands, 25-27 May 1983. Univ. of Hawaii. Honolulu: Univ. of Hawaii Sea Grant College Prog. Vol. 2:149-160.



NOAA botcam photo

Both the eggs and larvae are assumed to range from the surface down to the lower limit of the adult depth range (400 meters, or 1,200 feet). A recent model for the main Hawaiian Islands, based on a pelagic larval duration of 45 days, found that a median distance for successful settlements was around 100 kilometers (62 miles) and that cross-channel dispersal can be common.

### AGE AND GROWTH

Aging pink snapper is challenging because the otoliths (ear bones) lack well-developed annual growth zones. Maximum age was previously thought to be 18 years, but radiocarbon dating shows it to be closer to 40 years with the maximum age at 43 years.

'Opakapaka have a maximum length of 39 inches and a maximum weight of 18 pounds.

### NATURAL MORTALITY

About 15 to 30 percent of the stock dies to natural causes (such as predation or disease) on an annual basis. Only about only 1.5 percent of the population reaches the maximum age.



Otolith X-section  
Drill bit

## The ABCs of Stock Assessments

### HOW ARE STOCK ASSESSMENTS IMPORTANT TO FISHERIES?

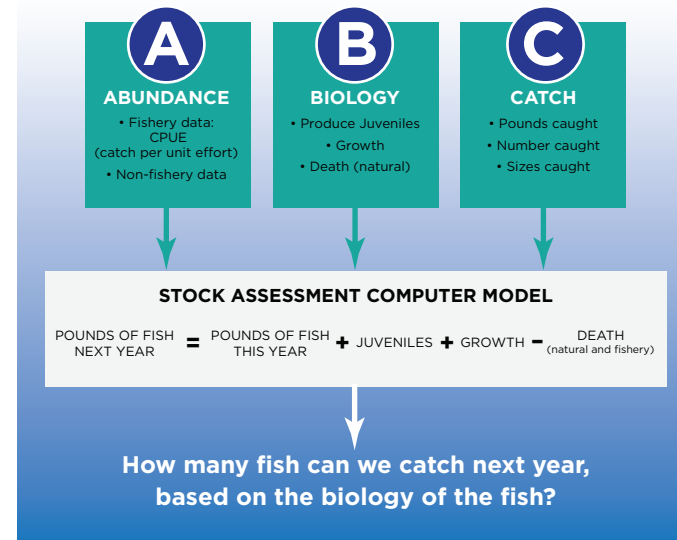
Stock assessments provide fishery managers with information they need to determine annual catch limits.

### WHAT IS A STOCK?

A stock is a group of fish that lives, reproduces and dies (naturally or caught by a fishery) together.

### WHAT IS A STOCK ASSESSMENT?

A stock assessment is a scientific analysis of the Abundance of the stock, the Biology of the fish through time (i.e., life history) and the Catch.



### HOW CAN FISHERMEN GET INVOLVED?

Provide researchers with fish at the needed sizes so they can better understand the life history of the fish. Once the otoliths (ear bones to determine age) and gonads (reproductive organs to determine sexual maturity) are removed, the fish are often returned to the fishermen.

Fill out trip report forms! Reported information is confidential. Knowing fishing effort and the fish caught, scientists are able to determine stock abundance and fishing mortality. When fishermen report their catch, stock assessments are more accurate.

### REFERENCE

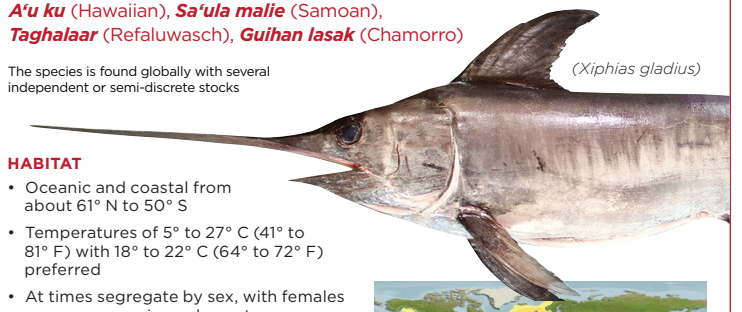
- Yau A (NOAA Pacific Islands Fisheries Science Center). How are stock assessments important to fisheries? Presented to the Western Pacific Regional Fishery Management Council's Fishers Forum on Stock Assessments, 17 March 2015, Honolulu.

## Life History of Swordfish

A'u ku (Hawaiian), Sa'ula malie (Samoan), Taghalaar (Refaluwasch), Guihan lasak (Chamorro)

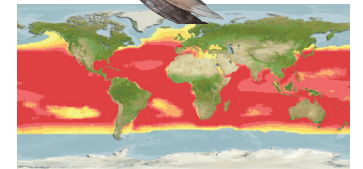
The species is found globally with several independent or semi-discrete stocks

(*Xiphias gladius*)



### HABITAT

- Oceanic and coastal from about 61° N to 50° S
- Temperatures of 5° to 27° C (41° to 81° F) with 18° to 22° C (64° to 72° F) preferred
- At times segregate by sex, with females more common in cooler waters
- Concentrate in productive areas sometimes shared with seabirds, squid and sea turtles
- Prefer convergence zones where warm currents meet cool nutrient-rich waters
- Migrate seasonally
- Typically in deep waters during the day
- Prefer banks, seamounts and continental shelves
- Surface at night, sometimes rapidly from depths greater than 600 meters (2,000 feet)



Global swordfish distribution



### AGE AND GROWTH

- Larvae hatch at 4 millimeters (less than 1/4 inch)
- Rapid growth and early maturity
- Females larger, grow faster
- Nearly all swordfish greater than 136 kilograms (300 pounds) are female
- Maximum recorded weight 635 kilograms (1,400 pounds)
- The oldest observed swordfish was 12 years of age

### DIET

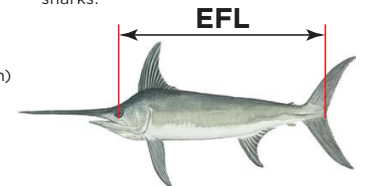
Swordfish are adapted to hunt and feed in cold, deep waters. They are opportunistic and feed on fish and squid.

### REPRODUCTION

- Estimated 50% of males mature at 102 centimeters (40 inches) eye-to-fork length (EFL)
- Estimated 50% of females mature at 144 centimeters (57 inches), i.e., about 4 years
- Broadcast spawning in surface waters (ideal, 23° to 24° C, 73° to 75° F)
- Spawning throughout year in tropics. Spring/summer in temperate regions
- High fecundity (millions of eggs/spawn)
- Solitary pairing of males and females

### NATURAL MORTALITY

Juveniles are vulnerable to predation by a wide range of predatory fish. Adults have a few natural predators, such as killer whales and shortfin mako sharks.



### REFERENCES

- Demartini E, Uchiyam JH and Williams H A. 2000. Sexual maturity, sex ratio, and size composition of swordfish, *Xiphias gladius*, caught by the Hawaii-based pelagic longline fishery. Fishery Bulletin. 98:489-506.
- Itano D. Swordfish Life History, Habitat and Fisheries Overview. Presented to the US West Coast Workshop: Working towards Sustainability, 10-11 May 2011. San Diego, Calif.