Near Shore Fisheries

Overview:

Near shore fishing is both used by the commercial and recreational fishery. Therefore, this fishery needs to be fully managed. Remote sensing and GIS both help in the management of these areas by the coast. The papers that I reviewed mostly looked at remote sensing, in particular, the Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS), ARGOS, Advanced Very High Resolution Radiometer (AVHRR), ARGOS transmitters, and NOAA polar-orbiting satellites. All of these satellites help manage near shore fisheries with sea surface temperatures, location services, and light sensors. GIS is not widely used in the fishing industry due to the issues with mapping in a 3D world of the ocean. GIS is mostly used to map locations on the surface of the ocean for future references to the specific location of where species were caught or where fishing boats were located.

Two of the most interesting articles I reviewed looked at squid, in particular the California squid off the coast of California and the jumbo flying squid off the coast of South America. These articles looked at the fishery of both of the squid species in a very specific way. The fishery for squid use high wattage lights that when turned on will cause squid that are in the deep or in the water column to move to the surface to the lights and all congregate together. This makes fishing easy for the fisherman once they find a great location because the fisherman are able to use purse-seine nets and sweep all the squid up at once. This fishery is very specialized for certain types squid and can be hard to manage due to the difficulties in finding out where the population is. This is because you can not rely on fisherman to give accurate catch information and if the fisherman do not find a location where there are high amounts of squid then the fisherman will not catch anything. Therefore, remote sensing became a huge role in the management of the squid fishery. The Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS) was used to further manage these species. When the high wattage lights are turned on, the light sensitive sensors on the satellite pick up the lights and are able to give an accurate location of all these fishing boats (Maxwell et al., 2004). This not only gives the location of the boats but the location of the squid as well. Therefore, with the location of the squid you can make inference to how large the population is and try to further manage these squid species. If the fishery ever needed to be closed down, now we would know exactly what the locations are and around it to stop fishing in those areas.

One article used ARGOS transmitters and satellites to look at the fishing induced mortality of sea turtles. Today, most sea turtle species have transmitters on their carapace. The purpose of these transmitters are to look at the exact location of the sea turtles to see where they are migrating to, as well as, whether or not the species in submerged (Hays et al., 2003). The article made an inference to whether or not the sea turtle has been killed due to fishing by looking at if the turtle was brought on land into villages or whether the turtle has been submerged or not submerged for long periods of time. Due to these transmitters, the article was able to find that three sea turtles were definitely killed and brought into villages because of the location services and information from the satellite and transmitters. These transmitters are an excellent resource to look at how this struggling, protected species is surviving and whether or not more management needs to be put in place.

Other articles used sea surface temperature from the Advanced Very High Resolution Radiometer satellite system (AVHRR) to further look at species and try to manage them. The articles that used this satellite system were looking at South African pelagic fish, coho salmon, and the skipjack tuna. The purpose of the article that looked at South African pelagic fish was to try and connect sea surface temperature and the density and location of South African anchovies, round herrings, and sardines (Agenbad et al., 2003). When these three species of pelagic fish are juveniles, they all congregate together and then when they are adults all separate into different areas by the coast. The results of this article directly used sea surface temperature and catch per unit to figure out the direct preferences of each species. The results concluded that the South African anchovy stayed inshore in colder upwelled waters, while the sardine and herring moved off the coast by the shelf area where there was warmer waters (Agenbad et al., 2003). Due to the information found in this article, these three species can be further
managed by location as well as sea surface temperature and can be used when there are fluctuations in sea surface temperature to locate where the species will be. The next article looked at juvenile coho salmon off the coast of Alaska to the northern coast of California. This article used two satellite systems for their survey, the AVHRR and the NOAA polar-orbiting satellite. The purpose of this article was to find fluctuations in sea surface temperature that would connect to the decline in juvenile coho salmon (Cole, 2000). The article found that when the sea surface temperature increased, the coastal upwelling decreased, which all caused the juvenile coho salmon population to decline. This has many implications with future management. Unfortunately, with global climate change and the potential of a two to three degree increase in temperature, the increasing sea surface temperature will greatly effect the coho salmon. With this study, they found that when the sea surface temperature increased the coastal upwelling greatly declined. This effects the possible food and nutrients that are upwelling from the sea bottom that the coho salmon feed on at the surface. With climate change, further management of the coho salmon needs to be considered. The last paper that used sea surface temperature looked at skipjack tuna. This survey used data from the AVHRR to find relationships between sea surface temperature and seasonal variability to the location of these tuna (Andrade et al., 1999). The results of the article found that when the sea surface temperatures were higher off the coast of Brazil, the catch per unit of skipjack tunas increased.

In conclusion, remote sensing is a huge part of the management of marine species through location services, sea surface temperature, and light sensor satellites. In the future, with the climate changing, it will be a very important tool especially for sea surface temperature. Every species is either going to adopt to the changes and move locations or not survive. Sea surface temperature will be the key to figure out where marine species habitats are and how we can further manage them.

Annotated Bibliography:

This article looks at the squid (Loligo opalescens) fishery off of the California coast, in a shallow nearshore spawning grounds, by using the Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS). This system provide visual confirmation of fishing vessels to measure the fishing effort by the detection of boat lights. This system uses nocturnal aerial surveys to detect lights by the satellites. The squids abundance is readily impacted by environmental variability like El Nino and La Nina. It is also considered an integral component of California’s pelagic fishery, so it was included in the Coastal Pelagic Species Fishery Management Plan (Maxwell et al., 2004). Therefore, the aerial surveys are an important part of the fishery system. The fishery consists of specialized light-boats that shine high intensity lights on the water, which then attract and congregate the squid near the surface. Then the seiner boats capture the squid with purse-seine nets (Maxwell et al., 2004). The lights that are used to congregate the squid are detected by the DMSP-OLS satellites. This collects data for later use in environmental management by the location of the boats and how many boats are in the fishery and how often the fishery is used for landings of squid to obtain the landings per unit effort. The results of this article mainly looked at how the squid (Loligo opalescens) were negatively effected by El Nino and positively effected by La Nina. This paper directly uses remote sensing to solve management issues of squid which was very interesting and well represented.

This purpose of this article was to look at the density of the South African anchovy (Engraulisi capensis), sardine (Sardinops sagax), and round herring (Etrumeus whiteheadi). The article looks at these species and their variabilities with the coastal upwelling zone along South Africa. One of the main factors that is looked at is sea surface temperature data from the last two decades of satellite data from AVHRR. Most of the three species will stay together when juveniles but then congregate in separate areas according to species when they become adults. While anchovies remain inshore in cold water, the sardines and herring inhabit areas by the shelf that are both warmer. To get a better understanding of these variabilities the article used commercial fish catch data and the sea surface temperatures to predict the locations where there would be high densities of each species. The
paper was written before the observer program was put in place so their catch data to find out how many of each species are in each area is highly variable. The article also found, that temporal effects on sea surface temperature was a factor in where the species habitats are. I think this study should definitely be done again with the observer program data to get more catch information.

This article looks at the Jumbo flying squid (Dosidicus gigas), which supports a major fishery in the Eastern Pacific off the coasts of North and South America. This article uses the United States of Defense Meteorological Satellite Program-Operational Linscan System (DMSP-OLS) in coordination with the ARGOS system. Using the ARGOS system provides data makes it possible to estimate fishing effort in terms of the area illuminated by fishing fleet. The light emitted by the fishing fleet is recorded by the DMSP-OLS satellite which can provide information such as the distribution and abundance of squid jiggers, the distribution of exploited squid stocks, and locations of favorable fishing grounds. Data on the distribution of individual vessels were obtained via satellite tracking using the ARGOS system (Waluda et al., 2004). This article also used GIS to map the vessels location and main fishing area. This paper was very well representative of how remote sensing can be used in near shore fisheries. The paper directly uses the satellites to sense the lights coming off the boats which is very interesting.

This article looks at the direct quantification of the level of mortality of sea turtles due to fisheries by-catch using satellite-tracking records. Sea turtle populations are in a great decline due to human activities due to fishing and are now a protected species. This article used Argos transmitters which are attached to adult marine turtles around the world. The transmitter provides the location of the sea turtles, as well as, the submergence patterns which looks at when the turtle is onshore or submerged in sea water. The methods of the article took the Argos information to figure out if the turtle was captured or had been killed. The information looked at the sudden movement of tracked turtles to inland villages, the sudden increase in the rate of good quality locations received which indicated the transmitters were no longer submerged, and the direct information from submergence sensors indicating the turtles were no longer submerging. The results concluded that in a total of 5923 days, the data suggested that 6 turtles may have been killed where 3 were confirmed due to the fact they were in villages. I thought this paper was very interesting and could be used for a larger scale to find illegal fishing of not just sea turtles but other endangered species. The paper uses a simple factor of whether the species was brought inland which I think is the most important factor of the paper. Although it is highly variable due to the fact fisherman could just take of the tags.

In this article sea surface temperature images, obtained by satellites in remote sensing, were used to investigate the relationship between fluctuations in the survival of juvenile coho salmon and coastal dynamics off the northwestern United States. Coho salmon are used for both recreational fishing and commercial fishing in Alaska all the way to northern California. This type of salmon spends little time in estuaries and then moves to the ocean and remains close to the coast. The purpose of this article was to use Advanced Very High Resolution Radiometer (AVHRR) and sea surface temperatures from NOAA polar-orbiting satellites to see if there is a relationship between sea surface temperature and the drop in survival of the hatchery-reared coho salmon since the mid 1980s. The results of this article found that when there was a warmer sea surface temperatures the coho salmon hatchery declined due to not only temperature, but the effects of this from a decline of coastal upwelling, therefore, less nutrients were brought to the surface. Also, when the sea surface temperature was cooler it had great effects for the coho salmon. I thought this article was very interesting and was well written for the effects of sea surface temperature and coho salmon.

The purpose of this article was to look at the relationship between sea surface temperature and catch per unit effort for the skipjack tuna (*Katsuwonus pelamis*) fisheries off the coast of southern Brazil. Fisherman use the pole and line method to try and catch the skipjack tuna. The tuna show a strong seasonal variability due to the environmental conditions. Due to their warm body temperatures, the skipjack tuna usually finds itself in warmer waters. The sea surface temperatures in this survey were obtained by satellite images and in situ measurements. The results of this article found that the sea surface temperature directly related to where the skipjack tunas were being fished. The higher the sea surface temperature, the more skipjack tunas there were. The catch per unit effort is greatly related to seasonal variability, where in the spring and summer months when the waters might still be on the colder side there is a higher catch per unit effort. I thought this article was very interesting due to the fact that it set up parameters of how the species survives and how the fishery is using these parameters of sea surface temperature and seasonal variability to catch more tuna. The sea surface temperatures and seasonal variability can now be used to help manage this magnificent species of the skipjack tuna.