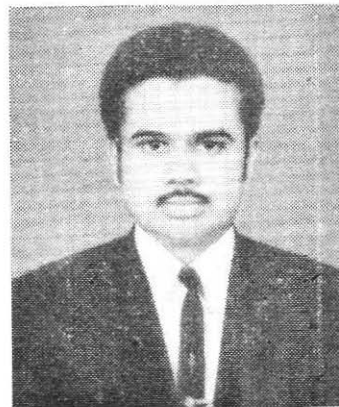# INTERPRETATION OF FISH SHOAL INDICATIONS IN THE ARABIAN SEA

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Introduction

Availability of resources is perhaps one of the most important factors which determines the success of any industry. In the case of the fishing industry, at the basic production level, the availability of fishable concentrations of fishes and other marine life is the decisive factor which controls the economy of the whole system. Even when well equipped vessel, fishing gear and trained personnel are available, the success of the industry is dependent on the availability of fishable concentrations of commercially important marine life at the appropriate time. By the word' fishable concentrations', the implication is availability of sizeable quantities of fishes which could be definitely caught using a particular type of craft and gear in a particular area at a particular time. Naturally, with the availability of fishable concentrations of commercially important marine life, the chances of getting a good catch are always high. Hence it assumes great significance at the basic production level of the industry.

Some knowledge regarding the presence of similar fishable concentrations of fish and other marine life is of great importance to the technical skill working on board fishing vessels. Their technical knowledge in fishing could be put to use more effectively when positive indications with regard to the availability of shoals are known to them. The correct and quick interpretation of these indications would place them in a better position from where they can use their judgment towards achieving great success in this endeavour.

In India, only very little work seems to have been done along these lines especially to arrive at a positive correlation between certain natural indications and presence of fishable concentrations of commercially important marine life, especially the shoaling fishes. The work done by Balan (1961) is worth mentioning in this context where the author has made certain observations on the shoaling behaviour of the oil sardine off Calicut along the Kerala coast.

Fish shoals

Fish shoals are naturally accumulated group of fishes which under normal conditions show a tendency to remain together. The commercial feasibility of operating certain specific types of nets (Purse seines, Cast net, Ring nets, Rampani nets, Patta bala, Mari bala, Colli vala etc.) is dependent on the availability of fishable concentrations of commercially important shoaling fishes. The necessary knowledge regarding the behaviour of similar shoaling fishes will enable us to use the specific type of fishing gear more effectively, thereby increasing the catches. Absence of such knowledge can result in wastage of valuable time, labour and above all money. The behaviour of a fish shoal is certainly decided by the variations observed in the various environmental factors both meteorological and hydrographic, such as direction and force of wind, amount of cloudiness, phase of the moon and tide, temperature, salinity, dissolved oxygen content, currents, presence of organic and inorganic particles and their intensity and the like. Eventhough, in general, fishes are known to swim against the prevailing currents during day time, at night many of them are found to drift along with the current, sometimes evidently in the midst of food items on which they feed.

Fish shoals common around Indian waters could be broadly divided into two major groups, viz.,

1) Surface shoals

2) Submerged shoals.

In the case of the first category, the shoal itself or rather individual fishes (of sufficiently large size) would be visible from the deck of a fishing vessel. Among the second category there can be two types viz, those which are visible and those which are not visible. The visibility is usually governed by factors such as amount of light and transparency of the water column and above all the depth at which the shoal moves. Based on their habits, shoaling fishes give different types of indications suggesting their presence in a particular area/depth of the sea. The correct interpretation of these indications is of great importance as otherwise there is every possibility of losing the chances of a good catch, by employing a particular type of fishing method.

Indications and Interpretations

(A) *Movement in the surface waters :* When the shoal moves up in the surface waters small sized ripples are created depending upon the size of individual fishes. It is presumed that the distance between two successive waves is more or less equal to double the thickness of individual fishes. They can be spotted from a distance of 7 to 8 km. and are usually dark in colour. Fishes which are found in similar shoals are mostly cat fishes, sciaenids, seerfish, anchovies barracuda, carangids, mackerel, sardines. gray mullets, etc.

(B) *Taking water through the mouth while moving :* During winter when sea water temperature shows a sudden fall, certain fishes move towards the sea surface and while moving they keep their mouths open half above the water surface. Cat fishes, sciaenids, Otolithus sp., gray mullets, carangids etc. belong to this category and can be easily spotted.

(C) *Showing the dorsal fin above the water level while moving :* This is a typical characteristic of Cat fishes and carangids.

(D) *Flying movements above the water level :* Certain fishes when they get frightened or when chased by other fishes exhibit flying movements above the water surface, covering distances of 20 to 30 m. at a time. The typical examples are the flying fish (Exocoetus sp.) and fishes like Hemiramphus sp. etc.

(E) *Keeping the gills open while moving:* While moving in a shoal, fishes like mackerel and sardines are known to keep their gills wide open and move sideways.

(F) *Splashing movements :* According to the law of nature, bigger carnivorous fishes feed on smaller fishes. These carnivorous fishes usually take advantage of fish shoals. When the shoal is suddenly attacked the smaller fishes show a tendency to move faster to escape the predators and while doing so cause a certain amount of splashing of water at the sea surface. Eg. sardines, mackerel, silver bellies, prawns etc. The common predators encountered are Sharks, seer, fish dolphins, saw fish, leather skins etc.

(G) *Jumping movements :* Some fishes are in the habit of jumping above the water line, at certain intervals. Sometimes it so happens that they push the anterior part of their bodies up and before the tail portion leaves the water surface, the head once again plunges back into the water. Sometimes similar movements are repeated at longer intervals of 5 to 6 minutes. Cat fishes, sardines, silver bellies, anchovies etc. belong to this category.

(H) *Individual fishes moving up and splashing the water surface and then going down :* In a fish shoal, sometimes individual fishes come up and go down quickly thereby splashing the water surface. If the movement is slow, the water movement caused by this splashing will resemble the movement caused by rainfall at the sea surface. Similar indications are characteristic of shoals of anchovies, carangids, and Ambassis sp. (near fresh water outlets into the sea)

(I) *Individual fishes cutting the water surface and moving back :* Sometimes from a moving shoal a few of the fishes move up and cut the water surface by their tail and move down to join the shoal. If the shoal is moving nearer to the sea surface, the shoal would be visible. Fishes like Tuna, seer fish, leather skins and carangids give similar indications.

(J) *Shoals which release a thin film of oily secretion :* Oily secretions are characteristic of waters where shoals of cat fish, sharks rays (especially Aetobates sp.), mackerel, sardine and carangids are common. Certain varieties also give a peculiar smell. One cannot always expect the shoal directly underneath these oily patches as these patches are found to move along with the prevailing wind and water currents.

(K) *Changes observed in the colour of surface and bottom waters :* Generally, fishes which exhibit coloured indications do not make other visible signs. The dorsal surface of a large number of fishes in a shoal when seen from the surface reveals specific colourations depending upon the species. In the case of fishes like pomfrets which exhibit sideways motion, the colouration exhibited is that of the lateral side. Bottom fish shoals like those of golden anchovy reveal a reddish tinge, probably brought about by a combination of the dorsal colouration of some of these fishes and also the reflected radiation

from the sea bottom. Surface fish shoals, in general, are blackish in colour.

The above said feature is noticed in the following varities of fishes viz. Crescent perches, sharks, soles, prawns, white fish, rays, kilimeen, ribbon fishes, polynemids etc.

(L) *Bubbles appearing at the sea surface :* When certain fish shoals move underneath we are likely to come across either individual or large number of bubbles in the surface layers. In general, bubble forming shoals are found to move rather slowly. Fishes which exhibit this characteristic are sardines, engraulids, cat fishes, carangids, white fish etc.

(M) *Slow movement of surface water above the shoal :* It is rather difficult to differentiate between a similar slow motion of water caused by a moving shoal (submerged) and an ordinary low intensity water current caused by a favourable wind. If the water column is sufficiently clear, part of the shoal itself would be visible.

The following major types of water motion are observed in the case of fishes noted against each:

(1) Formation of a small wave caused by the movement of a shoal from one place to another very near the surface. (Mackerel, sardines etc.)

(2) Surface water moving with low intensity splashing noise caused by a moving shoal. (Carangids)

(3) Formation of a whirling motion caused by the movement of a fish shoal which moves in circles. (Mackerel, sardines, carangids & cat fishes) Sometimes the speed of the shoal and the resulting water motion at the surface can be so high that it can capsize small boats which go nesr the shoal.

(4) When a sufficiently fast moving fish shoal moves at the sea bottom, particularly in shallow areas, muddy water usually comes up towards the surface layers. This is especially the case in areas where the sea bottom is composed of loose mud. (Mackerel, sardines, carangids, anchovies, cat fishes, soles & rays).

(N) *Shoals which are visible at night due to phosphorescence :* Certain fish shoals are bioluminiscent. Fishes like Silver bellies (Leiognathids), Bombay duck (Harpodon sp.) etc. will illuminate a large area of the sea and at times one may find it difficult to differentiate these fishes from the bright light reflected back from the sea.

FALSE INDICATIONS: Some of the above said natural indications can also become false indications as the particular indication may not be due to the presence of a fish shoal. For eg. small waves which are caused by a favourable wind, current boundaries where two adjoining current streams form a mixed layer, places of diverging or converging currents, outlets of industrial or any type of naturally or artificially contaminated sewage flow, floating oil which has leaked out into the sea from oil tankers and the like, shadow of low clouds especially when they are moving, presence of swarms of other marine life (eg. Noctiluca sp.) which gives colour to the sea, under water rocks, flock of birds, bubbles released from the bottom mud in areas where

chemical decomposition is in progress etc. can act as false indications. Special care has to be taken while differentiating between the above said false indications and the real indications mentioned under the items A to N., before confirming the presence of a fish shoal and taking further measures for exploiting the same.

EFFECT OF ENVIRONMENTAL FACTORS ON FISH SAOALS:

I. Effect of Wind:

Along the west coast of India, in the presence of light easterly wind, the general tendency of a fish shoal is to move down into deeper water. This in turn can produce one of the indications listed under item M. 1 to 4 mentioned earlier.

When the wind is northerly the general tendency noticed in these areas is the shoal moving up towards surface waters. When the wind is southerly the effect is just the opposite. With a westerly wind the shoal shows a tendency to move shorewards. In rough weather fish shoals are generally found to move down into deeper water.

II. Effect of Light:

In general, shoaling fishes show a tendency to move towards light. Because of this, during morning hours shoals are likely to face the east and towards evening, the west. A more or less similar tendency is also noticed with the rising and setting moon. Most of the ffshes, especially Hemiramphus sp. and certain varieties of prawns are attracted towards artificial light at night. In Rampani fishing, artificial lights are commonly used to lure the shoal into smaller nets to be transported to the shore.

III. Effect of variations in temperature :

Every individual species of fish has an optimum temperature eventhough eurythermal fishes can survive within certain variations of temperature. It is generally observed that fishes show a tendency to aggregate together and form shoals when the water temperature falls below a certain optimum limit. When the water temperature rises, the fishes in a shoal are likely to spread out. This might be the reason why we come across more number of fish shoals around Indian waters during the months September to December when the sea water temperature is likely to fall. During the months March to July, when the sea is comparatively warm in these areas, the number of fish shoals observed are less. Certain shoaling fishes show a tendency to float at the sea surface during the peak of winter. During such time, these fishes are found to be comparatively sluggish. Eg. Rays, Crabs and the like.

IV. Effect of currents :

In general shoaling fishes are found to move against currents during the day time. During the night time, especially in the presence of large quantities of food materials, fishes are known to drift along with a particular water body which contains the food item. When the current speed increases beyond a certain optimum limit, even during day time, shoaling fishes are found to drift along with the currents. But while drifting it is observed that individual fishes in a shoal always face the current eventhough they drift along with the stream.

V. Effect of variations in salinity :

In areas where rivers discharge sufficiently large quantities of fresh water into the sea, the tendency noticed

is the spreading of fresh water at the surface (due to a low density) in the form of a tongue into the sea. It is generally observed that fish shoals always try to avoid the tongue of fresh water either by diving into deeper water or by occupying the two sides of the tongue where the effect of fresh water is negligible. The same tendency is also noticed in the presence of a sudden shower especially in localised areas eventhough it is quite possible that some of the euryhaline fishes may be able to withstand a certain variation in salinity.

VI. Effect of variations in the dissolved oxygen content:

Majority of the commercially important fishes require an optimum concentration of dissolved oxygen in the surrounding waters. If due to some reason the quantity of dissolved oxygen falls below a certain minimum, they show a tendency to migrate towards favourable environments. It has been observed that at certain times oxygen depletion can result in more or less complete absence of shoaling fishes in a particular region of the sea. Oxygen depletion is characteristic of enclosed or semi-enclosed water bodies where it is caused by poor vertical/lateral circulation processes. In the open sea the main cause seems to be the putrification of large quantities of dead organic matter coupled with poor circulation processes. An earlier record of a similar phenomenon reported from the shelf waters off Bombay (Banse, 1968) is worth mentioning in this context. This is especially true during the S. W. monsoon period in areas where the process of upwelling is active thereby bringing bottom waters with low dissolved oxygen concentrations to shallower depths. Banse (1959) has also shown that during

the S. W. monsoon period off Cochin, the decrease in the oxygen content of the nearbottom waters results in the disappearance of demersal fishes especially the dominant variety, Nemepterus japonicus.

Conclusions

The importance of knowing some of the above said indications along with their correct and speedy interpretation need not be stressed again. A fair knowledge regarding the various environmental factors and their effect on the behaviour of shoaling fishes will certainly enable the skipper of a fishing vessel to exploit the resources in a better way. This will also help him to use the right type of gear and other accessories to catch a particular variety of fish under certain specific conditions.

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