IDENTIFYING AND CODING COLOR ANOMALIES IN FLATFISHES

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ABSTRACT

Flatfishes with anomalous skin pigmentation are frequently collected during routine trawl monitoring in southern California. Most of the color anomalies have been designated "ambicoloration," but comparison of some of these abnormally colored fishes with true ambicolored specimens indicates definite differences.

De Veen has reviewed literature on color abnormalities and has produced a quantitative analysis (1969), which defines the color anomalies he observed in North Sea plaice (Pleuronectes platessa L.) and shows the relationship of these abnormalities to spawning stocks, parasitic infestation, and growth. On the basis of de Veen's paper, we have prepared a guide for identifying and coding flatfish color anomalies in the field. We recommend that color anomalies be recorded in this manner until further research indicates a need for different methods.

INTRODUCTION

Pigment abnormalities in flatfish are not uncommon and have attracted the attention of many researchers. Norman (1934) provided some early documentation on color anomalies,"hooking" (forward protrusion) of the anterior dorsal fin rays, and reversal in flatfishes. In a recent survey (Haaker and Lane 1973) varying degrees of abnormal skin pigmentation were observed in two species of flatfishes from southern California coastal waters. Abnormally pigmented fish have also been found elsewhere along the Pacific Coast of North America (Beardsley and Horton 1965; Miller 1966), and color anomalies in Atlantic and North Sea flatfishes have been quantitatively documented by de Veen (1969).

De Veen's analysis of color anomalies in plaice from the North Sea has provided insights and conclusions that may be significant to studies of southern California flatfishes. His descriptions and drawings of anomalies, in particular, may be useful in standardizing data from routine trawl monitoring in southern California.

DE VEEN'S NORTH SEA STUDY

From a review of literature on color anomalies in flatfishes and an analysis of pigment abnormalities in North Sea plaice (Pleuronectes platessa), de Veen has identified five major types of color anomalies: diffuse pigmentation, ambicoloration, albinism, goudschol ("golden plaice"), and xanthochroism. His definitions of each condition are shown in Table 1.* During a 4-year period, he examined over 34,000 adult male and 8,000 juvenile plaice from four distinct populations and two rearing grounds for these anomalies. His observations on one juvenile population are of particular interest (percentages are approximate):

Condition	Incidence 50 mm	150 mm	250 mm
Normal	75%	55%	43%
Diffuse Pigmentation			
Slight	25%	38%	45%
Moderate	1.0%	2.0%	3.0%
Heavy	0.5%	2.0%	3.0%
Albinism	0.0%	0.25%	1.0%
Ambicoloration	0.0%	2.0%	5.0%

(Xanthochroism was so rare in de Veen's samples that it was not considered in the study.)

*In some cases, we have modified or added to a definition to reflect various researchers' observations on southern California flatfishes.

As the table shows, the frequency of slight diffuse pigmentation, the most common anomaly, increased with increase in the size of specimens. This was also true of the adult populations surveyed; in adults, the incidence of albinism and ambicoloration also increased with increasing size. De Veen presented various hypotheses for the changes in incidence of all anomalies with size (and therefore age). He found that differences in total mortality and recruitment characteristics did not account for the observation and concluded that abnormal coloration can develop throughout the whole life span of the species.

De Veen found that a trematode parasite was responsible for diffuse pigmentation in juvenile plaice. The trematode infestation caused an increase in the number of melanophores on both sides of the fish: Melanophores on the blind side developed around the trematode cysts, giving rise to diffuse pigmentation. The incidence of cysts was highest in 70-mm fish and decreased to zero in 300-mm specimens. The frequency of the trematode infestation increased with proximity to the turbid waters of large commercial mussel beds in the study area. De Veen also noted that the goudschol phenomenon in juvenile plaice was directly associated with diffuse pigmentation and trematode cysts.

APPLICABILITY TO SOUTHERN CALIFORNIA STUDIES

Although only a few ambicolored flatfishes have been collected in southern California waters, many specimens (primarily dover sole and Pacific sanddab) with diffuse pigmentation have been taken. Scattered incidences of the other three color anomalies have also been reported (a xanthochroic dover sole was taken recently off Eureka, California (Warner 1972)).

A record of any type of abnormality is important in environmental impact and "background" studies, and documentation of color anomalies may be particularly useful. A number of researchers are now using parasites as biological tags in flatfish studies (Gibson 1972): As diffuse pigmentation may indicate a recent parasitic infestation--probably from localized sources, records of incidence of this anomaly may be useful in determining a population's residence time at a specific location. Data on this and other color anomalies may also be important in obtaining detailed information on recruitment, in assessing age-specific natural mortality rates of flatfishes from different nurseries, and in identifying the factors contributing to tumors in dover sole.

RECOMMENDATIONS

The table and figures in this paper, which are based on de Veen's 1969 paper, constitute a guide for identifying and coding flatfish color anomalies in the field. Table 1 lists the obvious characteristics of each condition and gives a code for the anomaly that can be used on field data sheets. Slight, moderate, and heavy diffuse pigmentation are shown in Figures 1 through 3. Figures 4 through 7 show ambicoloration and albinism; the letters for the different types of ambicoloration and albinism given in Figures 5 and 7, respectively, may be added to the anomaly codes AM and AL on field data sheets.

We recommend that investigators conducting trawling surveys record color anomalies using the codes given in Table 1 and Figures 5 and 7 until further research indicates the need for a different system. In addition, anomalously colored fish should be examined for associated abnormalities, such as "hooking" of the anterior dorsal fin rays, depression in the occipital region, and incomplete eye migration. Other anomalies (tumors, fin rot and tail rot, parasitic infestation, reversal, etc.) in specimens should also be recorded.

It is extremely important that the total number of specimens, both normal and abnormal, in a sample be recorded, and, if possible, the standard length of each specimen should be noted. Abnormally colored fish should be preserved if at all possible.

ACKNOWLEDGMENT

We are grateful to Dr. J. F. de Veen for permission to reprint the drawings from his 1969 paper on abnormal pigmentation.

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Table 1. Description of color anomalies in flatfishes and suggested field codes. After de Veen 1969.

Abnormality	Field Code	Description
DIFFUSE PIGMENTATION	DP	• Small spots on blind side • Spots irregularly distributed • Spots gray-yellow, gray, or pale brown in color • Differs from ambicoloration (described below) in that spots are distributed randomly (rather than concentrated in sharply defined, solid blocks of color) and are pale (rather than intense) in color
Slight Diffuse Pigmentation	SDP	• One or more tiny spots or groups of spots (Figure 1)
Moderate Diffuse Pigmentation	MDP	• Spotted area encompasses 10 to 50% of blind side (Figure 2)
Heavy Diffuse Pigmentation	HDP	• Spotted area encompasses more than 50% of blind side and may cover 100% (Figure 3)
AMBICOLORATION	AM[1]	• Intense pigmentation on blind side (Figure 4) • Color and pattern of abnormal pigmentation matches normal coloring of eyed side • Color in sharply defined, solid blocks (rather than in small, scattered spots, as in diffuse pigmentation) • Blocks of color may cover all or part of blind side (Figure 5) • Sometimes associated with head anomalies ("hooking" of anterior dorsal fin, depression in the occipital region, or incomplete eye migration)[2]
ALBINISM	AL[3]	• Unpigmented areas on eyed side (Figure 6) • Unpigmented areas may cover all or part of eyed side (Figure 7)
GOUDSCHOL PHENOMENON	G	• Yellowish color on eyed side of fish with diffuse pigmentation on blind side
XANTHOCHROISM	XA	• Yellowish or orange color on eyed side of fish with normal coloring (no diffuse pigmentation) on blind side[4]

1. Add letter from Figure 5 to code to specify type of ambicoloration.

2. This association has been noted in southern California fish (Haaker and Lane, in preparation) and in North Sea studies (Cunningham and MacMunn 1893), but was not observed by de Veen.

3. Add letter from Figure 7 to code to specify type of albinism.

4. This condition was rare in the fish examined by de Veen.

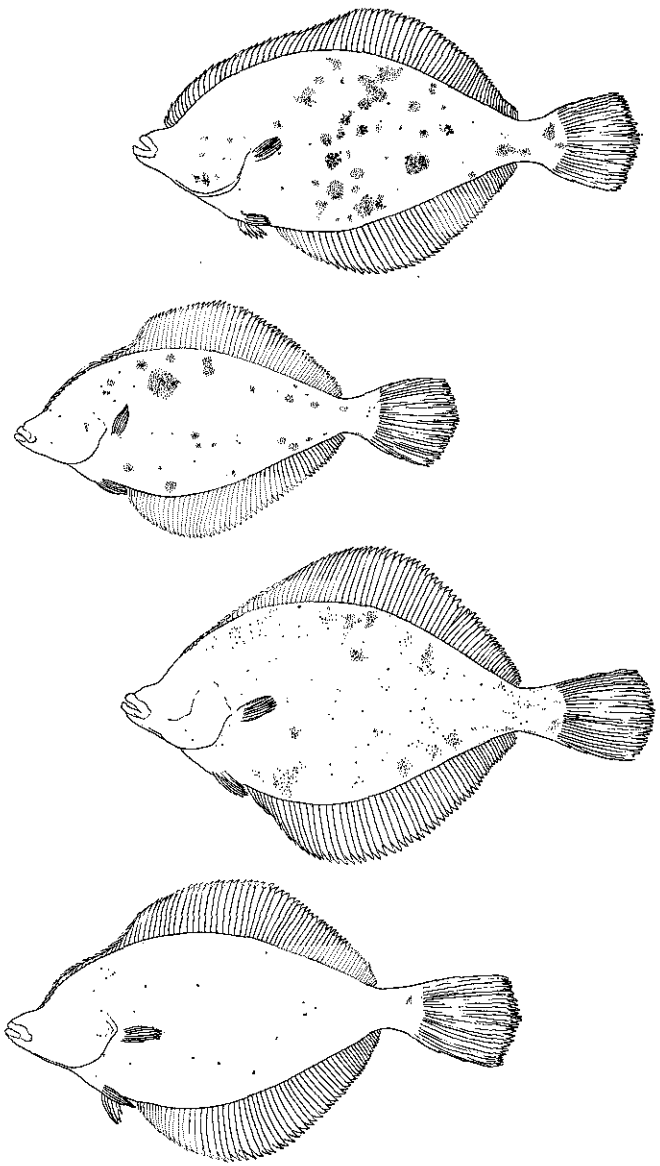

Figure 1. Slight diffuse pigmentation (field code: SDP). Reprinted from de Veen 1969, fig. 1.

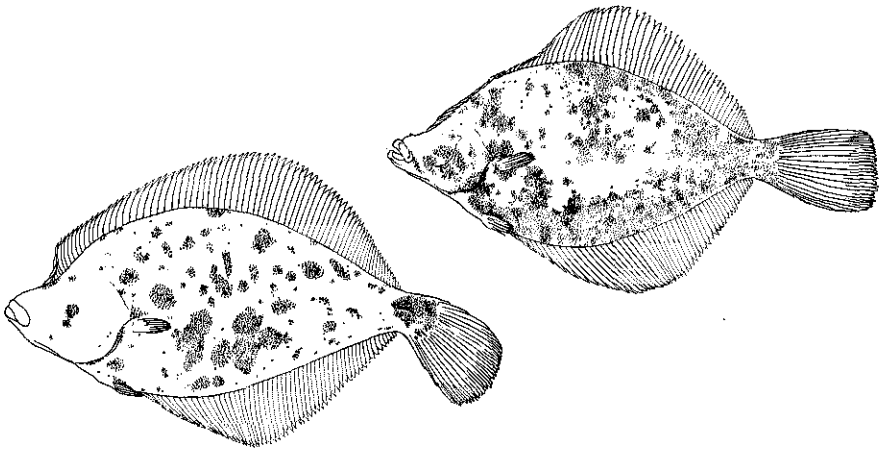

Figure 2. Moderate diffuse pigmentation (field code: MDP). Reprinted from de Veen 1969, fig. 2.

Figure 3. Heavy diffuse pigmentation (field code: HDP). Reprinted from de Veen 1969, fig. 3.

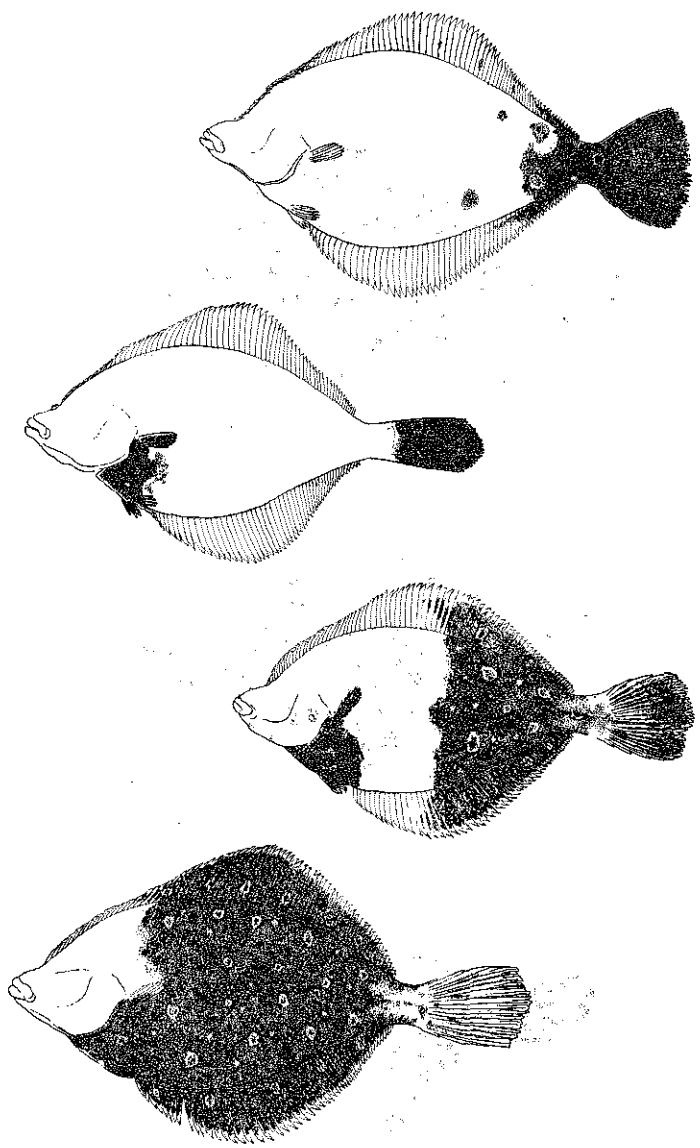

Figure 4. Ambicoloration (field code: AM). Reprinted from de Veen 1969, fig. 4.

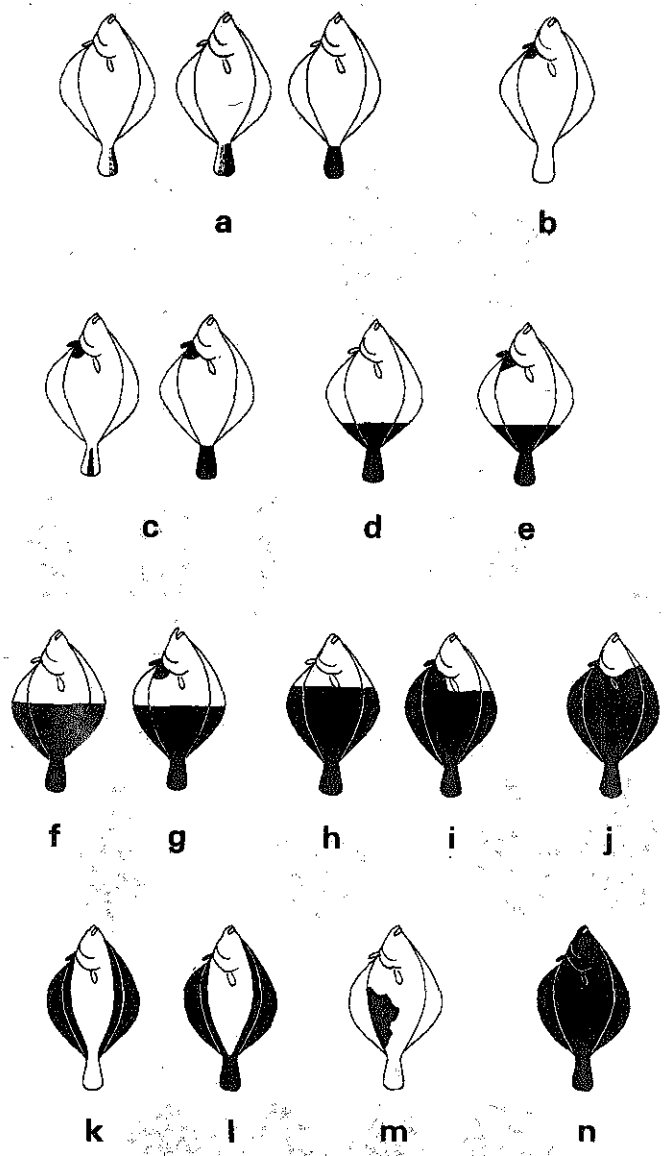

Figure 5. Types of ambicoloration (add letters to field code AM). Reprinted from de Veen 1969, fig. 9.

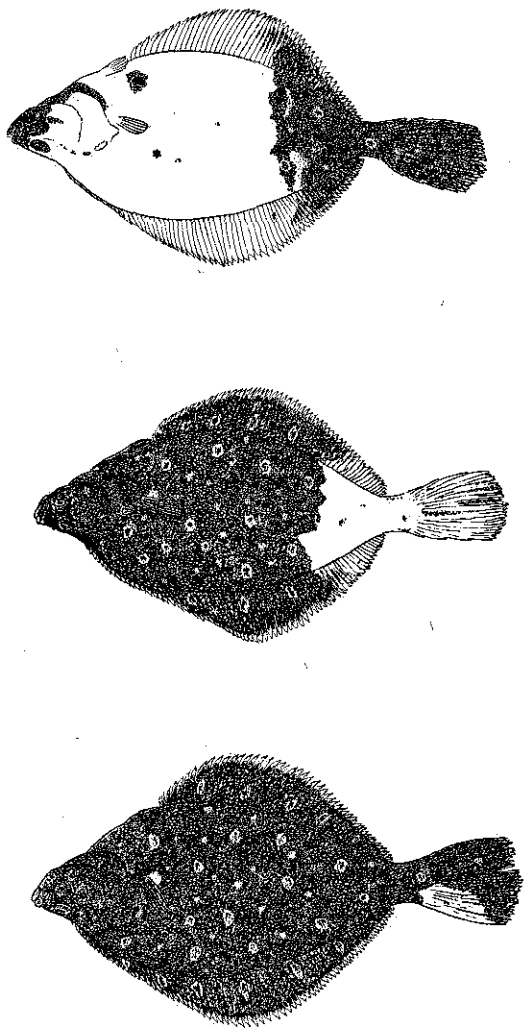

Figure 6. Albinism (field code: AL). Reprinted from de Veen 1969, fig. 5.

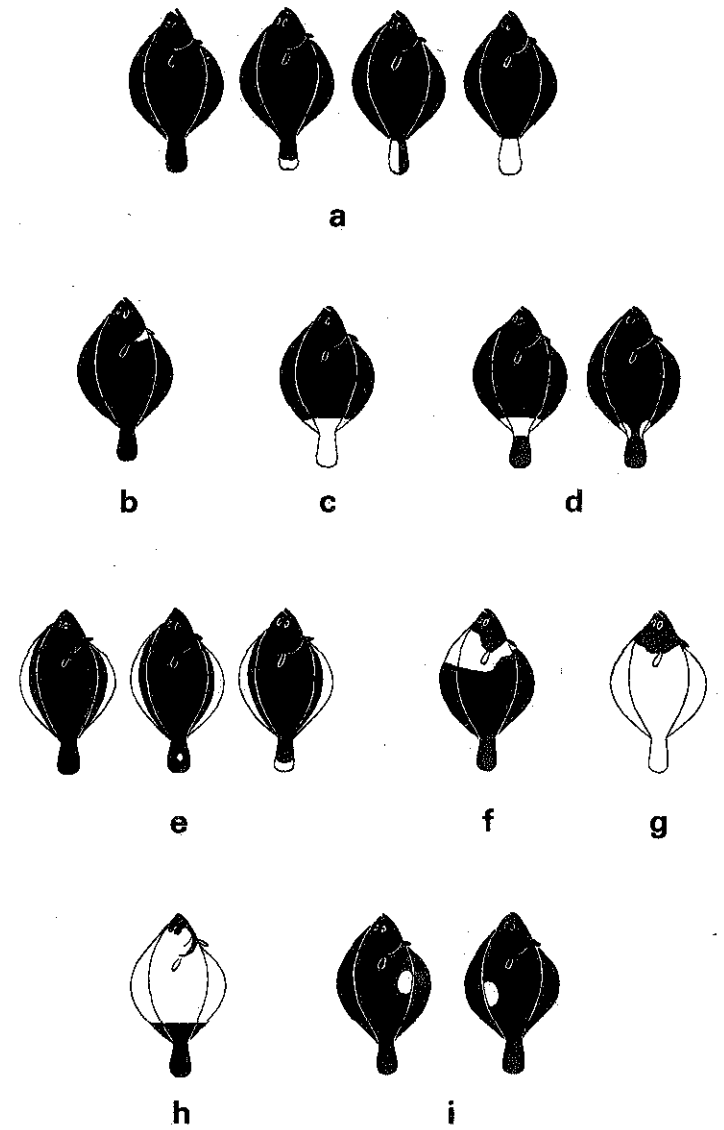

Figure 7. Types of albinism (add letters to field code AL). Reprinted from de Veen 1969, fig. 10.